

Gulf States Utilities Company

Beaumont, Texas



Industrial Transformer Superfund Site Health and Safety Plan

ENSR Consulting and Engineering

July 1991

Document Number 9504-002-003



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Industrial Transformer Superfund

Site - Health and Safety Plan

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HEALTH AND SAFETY PLAN

for

Site Remediation Activities

at the

Industrial Transformer Superfund Site

in

Houston, Texas

Project Number: 3260-013-340

Division Number: 42

Prepared By: _____

Date: _____

Approved By:

ENSR Health and Safety Manager : Date

ENSR Site Remediation Project Manager : Date

ENSR Field Operations Project Manager : Date

Galson Remediation Corp. Project Manager : Date

ENSR General Project Manager : Date

**HEALTH AND SAFETY PLAN (HASP), AND SPILL/EMISSIONS
RELEASE CONTINGENCY PLAN
SIGNOFF SHEET
FOR
Site Remediation Activities
AT THE**

Industrial Transformer Superfund Site

in

Houston, Texas

3260-013-340

I have received a copy of the Health and Safety Plan and the Spill/Emissions Release Contingency Plan prepared for the above-referenced site, I have read and understand its content and I agree that I will abide by its requirements.

Name

Signature

Company

Date

NOTE: Each ENSR employee and ENSR subcontractor is to receive a copy of this plan, read and understand the plan, and sign a copy of this page

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1.0 INTRODUCTION

This Health and Safety Plan describes the procedures, and provides the Health and Safety guidance that will be followed in performing the soils remediation activities at the Industrial Transformer Superfund (ITS) Site. The ITS Site has also been referred to in the past, as the Sol Lynn Site. The remediation activities are performed in accordance with the requirements of the Consent Decree in Civil Action Number H-89-2584, United States District Court for the South District of Texas, Houston Division, executed between the Environmental Protection Agency (EPA) and Gulf States Utilities (GSU) and entered by the court on January 8, 1990; and modified by a joint motion for modification filed by the parties in January 1991.

The information presented in this Health and Safety Plan has been developed to comply with 29 CFR 1910.120 for hazardous waste sites. This plan is not meant to diminish or replace any other set of occupational safety and health requirements specified in 29 CFR 1910-1926 or accepted industry practices that may be expected to be followed in accordance with the General Duty Clause of the Occupational Safety and Health Act.

All on-site personnel involved with the ITS Remediation Project will review and study this Health and Safety Plan will be thoroughly briefed on its contents, and will be required to adhere to and enforce rules established herein.

The Remedial Action Facilities, and Operating Procedures are described in a Design Report consisting of 2 volumes:

- Remedial Design Report - Volume I - Site Remediation and Preparation Treatment describes all site remediation and support activities, and facilities, other than the soil dechlorination treatment process design and operation.
- Remedial Design Report - Volume II - Soil Dechlorination Treatment describes the design of the mobile soil dechlorination treatment facilities, and the operating procedures that will be followed to achieve dechlorination of the PCBs in the soils, and to complete the site remediation activity.

This Health and Safety Plan describes the activities, procedures, and requirements that will be followed to minimize potential risk to all on-site workers, and the public while performing this remedial action. Health and safety concerns are paramount in

accomplishing all the tasks involved in this project. The objective of the Health and Safety Plan is to anticipate potential risks, and provide the necessary guidance for their control, during the practical field activities. The plan is based on the physical and chemical hazards that can be anticipated prior to beginning field work, and will be updated based on actual field observation and experience as the project progresses.

This Health and Safety Plan has been jointly prepared by ENSR Consulting and Engineering who is the managing contractor for the project, Galson Remediation Corporation who is the subcontractor performing the soil dechlorination treatment using their APEG-PLUS™ process, and Law Environmental, Inc. who provides technical support to Galson Remediation Corporation.

1.1 Project Organization

1.1.1 Organizational Structure and Responsibilities

This section describes the organizational structure, lines of authority, and responsibilities of key individuals for the project. Project health and safety activities will be performed within the framework of the organization and functions described in this section.

The organization for the project is designed to provide clear lines of health and safety responsibility and authority, supported by a management control structure.

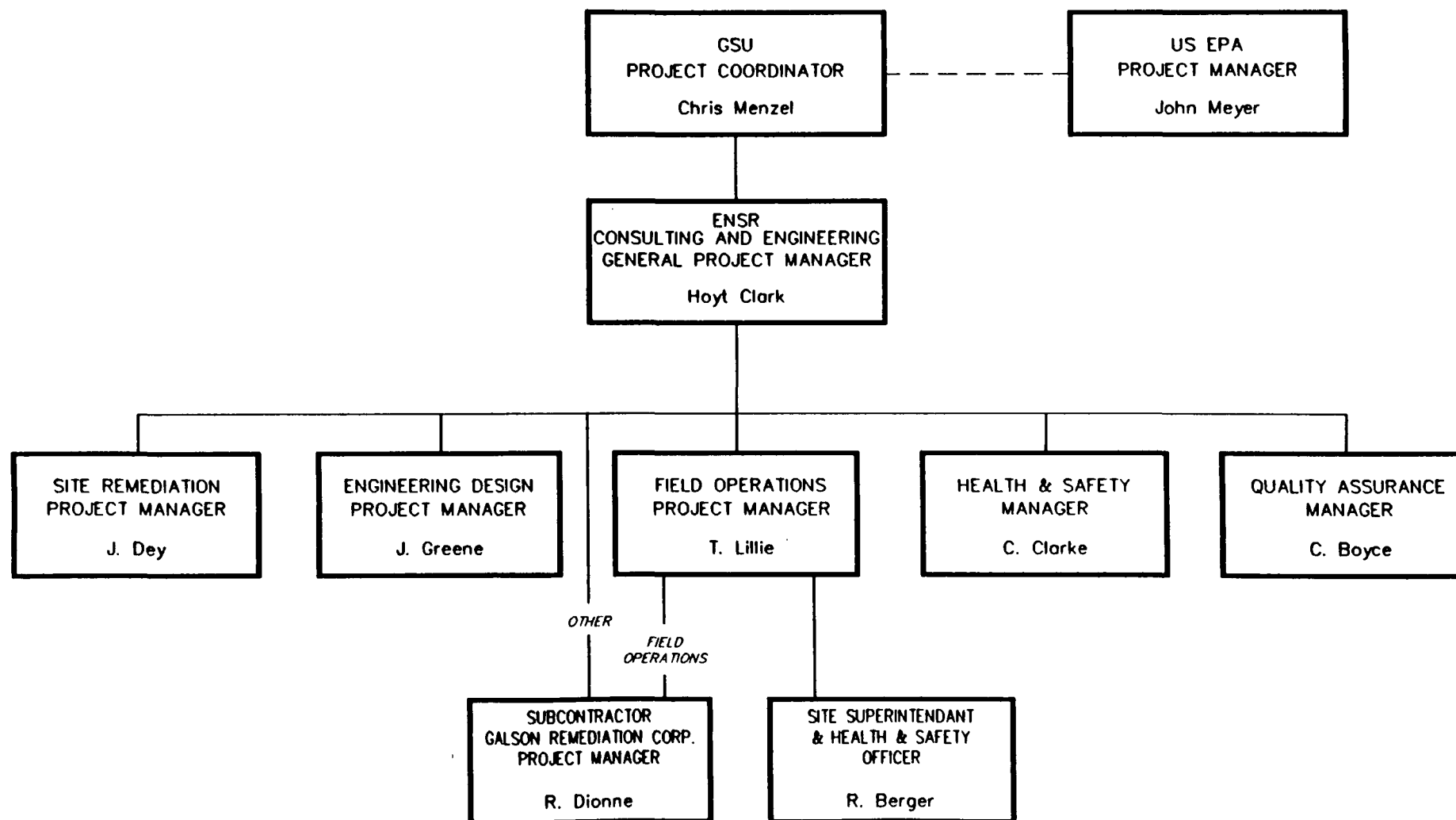
GSU personnel within the organizational structure hold overall management responsibility for the entire project.

As described in the Remedial Action Consent Decree, GSU has appointed a Project Coordinator who is responsible for management and direction of the Remedial Action Project. Mr. Chris Menzel, of GSU, has been designated to that position.

GSU has designated ENSR Consulting and Engineering as the Managing Contractor for the project.

The project organization chart is shown on Figure 1-1. The following paragraphs describe the organizational responsibilities for each function in the project organization.

FIGURE 1-1
SOIL DECHLORINATION TREATMENT PROJECT
ORGANIZATION CHART
INDUSTRIAL TRANSFORMER SITE



GSU Project Coordinator has overall responsibility for managing the remediation project to achieve Consent Decree requirements.

ENSR General Project Manager has overall responsibility for implementation of the remedial action project, including planning, organizing, staffing, implementation, and control to achieve the requirements of the GSU Project Coordinator and the Consent Decree. This includes responsibility for implementing the Health and Safety Plan, Quality Assurance Project Plan, Contingency Plan, and Community Relations Plan.

Engineering Design Project Manager has responsibility for designing and constructing all site facilities required for remediation, and support of remediation activities, except for the APEG dechlorination treatment unit itself. A staff of design engineers report to him and the field supervision of construction work will be implemented through the on-site Treatment Project Manager.

Site Remediation Project Manager has responsibility for site remediation, utilizing support of the other project managers in implementation of the activity. Prepares all EPA-required workplans and periodic reports, and prepares all status, cost, and schedule reports required to achieve project control.

Plans and directs all field sampling requirements to achieve site remediation verification and soils treatment verification, and the laboratory analysis activity for those functions.

Maintains all project cost reports and participates with the General Project Manager in cost-control activities. Also, participates in planning and implementation of the Project Community Relations Plan.

Represents the ENSR General Project Manager in his absence.

Field Operations Project Manager has responsibility for managing the subcontractor who is operating the treatment facility and achievement of soil treatment objectives. This includes implementation of excavation activities to remove PCB-containing soils from their existing location and stockpiling them for processing through the treatment facility. Has line responsibility for managing and implementing the site health and safety program consistent with the Health and Safety Plan.

The Site Superintendents and the Galson Remediation Corporation (GRC) Project Manager report to the Field Operations Project Manager and perform the actual field supervision activities under his direction.

The Field Operations Project Manager, and Site Superintendent coordinates closely with the GRC Project Manager in achieving successful operation of the treatment unit, and with the Site Remediation Project Manager in executing the site excavation activities.

Site Superintendent has responsibility for oversight of the treatment unit operation and site excavation activity.

Also functions as the Site Health and Safety Officer. Implements the field aspects of the projects Health and Safety Plan under the direction of the Field Operations Project Manager. Monitors actual field operations activities and assures compliance with Health and Safety procedure and intent.

Quality Assurance Manager is responsible for the conformance of project activities with requirements of the Quality Assurance Project Plan and for determining that activities fulfill the objectives for which they were designed.

Will assure that laboratory analyses are in compliance with the Project Quality Assurance Project Plan, and for preparation of quality assurance reports. Coordinates closely with the Site Remediation Project Manager in performing these functions.

Health and Safety Manager has oversight responsibility for Health and Safety (H&S) compliance with the H&S workplan and providing support to the Field Operations Project Manager in managing the project H&S performance. Performs field inspections as necessary to maintain knowledge of field conditions (see Site Superintendent Responsibilities above).

GRC Project Manager has responsibility for mobilization, testing, startup, and operation of the soils treatment unit. Has a staff of technical support, and operations personnel for implementation of these activities. Responsible for achieving remediation criteria of ≤ 25 ppm PCB in the treated soil.

Coordinates closely with the Field Operations Project Manager in implementing the APEG-PLUS™ treatment unit operation consistent with overall project procedures and objectives. The overall organization for Galson Remediation Corporation is detailed in Section 1.1.4.

1.1.2 Site Security

Security measures which will be in place during remediation will reduce the potential for unlawful entry and vandalism which could result in spills or releases of volatile emissions.

The entire WMU and process area is secured with 6-foot-high chainlink fencing and locked gates. Warning signs are located on the fencing to deter unauthorized entry to the site. Personnel will be staffed on site 24 hours/day while the soils dechlorination treatment process is on site. The gates will be locked during any time the site is unoccupied (prior to, and after the treatment process being on site).

Temporary security service coverage will be utilized to monitor the site on a spot basis when the site is not staffed with project personnel, and the General Project Manager concludes special surveillance is required.

1.1.3 Health and Safety Plan Implementation

The performance of this project will conform to the procedures of this H&S Plan. Any deviation from established procedure or from the H&S Plan must be approved by the General Project Manager.

The Field Operations Project Manager is responsible for ensuring compliance with all of the requirements of the H&S Plan.

1.1.4 Galson Remediation Corporation (GRC) Organization

The organization chart for overall GRC is shown on Figure 1-2.

The treatment system will normally be operated 24 hours per day, 7 days per week by 3 shifts of operating staff. Depending on the quantity of soil to be processed for the ITS project, these 3 crews may be augmented with a fourth relief crew. Each crew will consist of the following personnel:

- 1 - Shift Manager
- 2 - Field Technicians
- 2 - Laboratory Technicians

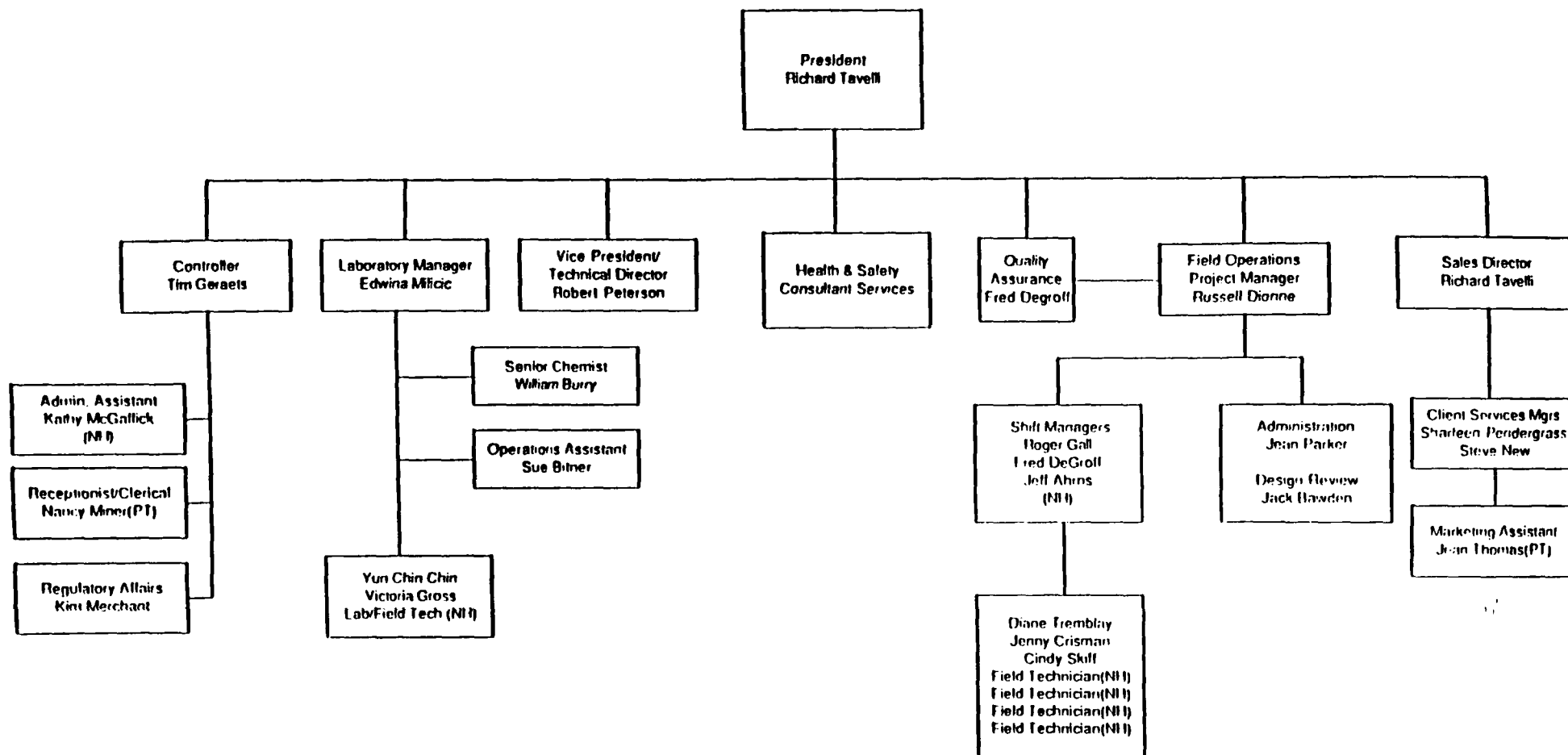


FIGURE 1-2 GALSON REMEDIATION CORPORATION - ORGANIZATIONAL CHART

PT Part Time
 NH New Hire
 • On Loan from GEA

The day shift on week days will also include the GRC Project Manager, a field maintenance technician, and an office clerk. The duties and responsibilities for each of these positions are listed below.

GRC Project Manager - Has overall responsibility to manage the operation of the treatment process to achieve a safe, healthy, and environmentally effective result. Supervise directly the GRC shift managers and the GRC office clerk. Supervise and coordinate the transportation, mobilization, site testing, treatment operations, decontamination, and demobilization phases of the ITS project. Resolve GRC field operating problems encountered with the assistance of the field crews. Primary point of contact for ENSR on all project issues. Review all invoices before they are forwarded to ENSR.

GRC Shift Manager - The GRC shift manager will be responsible for the operation and maintenance of the dechlorination treatment plant. The GRC shift manager will provide general supervision for a field crew of 5 field and laboratory technicians needed for process operations, maintenance and laboratory analysis. The GRC shift manager reports to the GRC project manager.

The GRC shift manager will also be responsible for all Health and Safety officer activities relating to the APEG-PLUS™ process unit. In this role he holds the same health and safety responsibilities as the Site Health and Safety Officer, applicable to Galson Remediation Corp. activities only. In this role he reports to the GRC Project Manager. Will coordinate closely with the site health and safety officer, and the Field Operations Project Manager to achieve project health and safety objectives.

GRC Field Technician - The GRC field technician will be responsible as a team member operating the full-scale mobile treatment unit. The GRC technicians must be capable of applying independent judgment and skills effectively to solve scale up and operational problems and to implement changes in operating systems. The GRC technician will be a team member of an operating team directed by a GRC shift manager. The GRC technician must be able to function with limited general supervision.

GRC Laboratory Technician - Responsible to work as a team member to assist in the analysis of materials contaminated with PCBs. Perform analysis of chemicals used in the treatment system with equipment such as GC and HPLC. The GRC laboratory technician will work under the supervision of the GRC shift manager.

2.0 SITE BACKGROUND

The ITS Site is located in Houston, Texas. As shown on Figure 2-1, the site is located just south of I-610 and west of Highway 288. The ITS Site encompasses approximately three quarters of an acre.

The area around the site is a mix of residential, recreational, commercial, and light industrial facilities. The light industrial, commercial business area is located directly to the east and south of the site. Astroworld and the Astrodome are approximately 4,000 feet north of the site. A mix of private, single, and multi-family dwellings is approximately 3,000 feet to the west. The residential population of the surrounding areas (1 mile in radius) is approximately 2,000 persons. A maximum daily traffic estimated at 100,000 persons may move within a 1-mile radius due to the proximity of the I-610 Loop and the recreational activities associated with the Astrodome and Astroworld.

History

The ITS Site is the location of a former electrical transformer salvage and recycling company which operated from approximately the early 1960s to the early 1970s. A chemical recycling and supply company subsequently operated at the same location during approximately 1979 and 1980.

In October, 1984 the site was proposed for inclusion on the National Priorities List. In September, 1985 the Texas Water Commission (TWC) entered into a Cooperative Agreement with the EPA to conduct the Remedial Investigation/Feasibility Study (RI/FS) at the site. Utilizing funds from this cooperative agreement, TWC contracted with Radian Corporation on June 30, 1986, for a technical assessment of the site. Field work began January 14, 1987.

The site was divided into two sections referred to as operable units - a Soils Operable Unit, and a Groundwater Operable Unit. The remedial action addressed in this Health and Safety Plan refers only to the soil remediation of the site. The Groundwater Remediation Operable Unit is being implemented under TWC supervision in a separate project.

Topography

Surface drainage around the site is accomplished by shallow ditches that border the site along Knight and Mansard Streets. These two ditches carry surface runoff by slightly different routes to Braes Bayou which empties into Buffalo Bayou then into the San Jacinto River Basin, which ultimately flows into Galveston Bay. The site is outside the 100-year flood plain.

Geology

Surface soils at the site and in the vicinity are of the Lake Charles series. These soils are characterized by somewhat poor drainage and high available water capacity. When the soil is dry, deep, wide cracks form on the surface where water can enter rapidly. When the soil is wet the cracks are sealed and water infiltrates slowly.

Below the surface soil is the Beaumont Clay, which is of Pleistocene age. The lithology of the Beaumont Clay is composed of unconsolidated clays and muds or deposits of clayey sands and silts. The clays and muds were deposited as interdistributary, abandoned channel fill, overbank fluvial or mud-filled coastal lake or tidal creek muds. The sands and silts represent alluvium, levee and crevasse splays.

The uppermost aquifer is encountered at a depth of 30 to 34 feet below ground surface. This particular aquifer is a water-bearing sand that varies in thickness from 2 feet to 6 feet, averaging 4 1/2 feet. Sand content increases from west to east across the site, from 50% to 70%. This aquifer is not used as a drinking water supply. The groundwater flows to the northwest.

The uppermost water-bearing sand is separated from the next lower, intermediate water-bearing sand by a stiff clay, approximately 45 to 52 feet in thickness. The intermediate water bearing sand is underlain by clay.

The major aquifers in the Houston area are the Chicot and Evangeline. These aquifers supplement surface water in supplying the City with drinking water. In the vicinity of the site, the shallowest well for the City of Houston is at 670 feet below the surface.

Remedial Investigation Results

During the Remedial Investigation (RI), samples were collected from soil, stormwater, and air to determine the nature and extent of contamination.

Because information collected previously by TWC indicates the primary contaminants at the site are polychlorinated biphenyls (PCBs) and trichloroethylene (TCE), the emphasis for the analytical testing was placed on determining vertical and areal extent of these two contaminants.

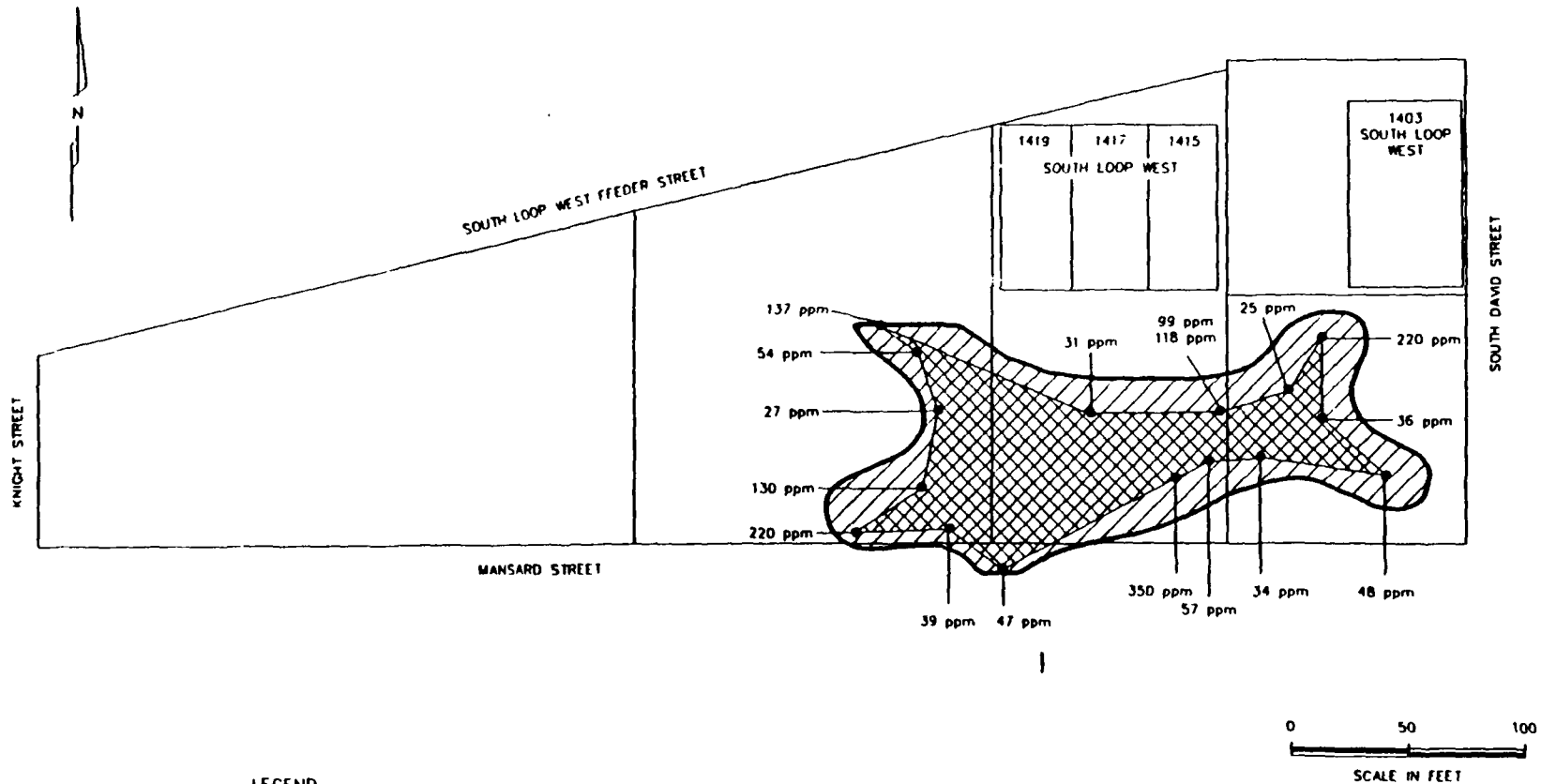
In the samples collected from the upper 2 feet of soil, concentrations of PCBs varied from 350 ppm at the middle of the site, to 118 ppm at the eastern edge of the site, to not detected in the western part of the site. Samples collected at the 2 to 4 foot depth indicated PCBs of less than 5 ppm.

Seven stormwater samples were collected from "ponded" areas on site and from the off-site drainage ditch areas. All samples were analyzed for PCBs. Only one sample of "ponded" water at the site near a contaminated area showed PCBs (0.0011 ppm). Two of the samples were analyzed for TCE. Only one sample of "ponded" water showed the presence of TCE at .0026 ppm.

Sediment samples were collected from the same location as the stormwater samples. The results of the sediment sampling showed that only one sample collected in a drainage ditch south of the site exceeded the cleanup criterion of ≤ 25 ppm PCBs. Air samples were also taken. The analysis of the air samples did not detect TCE or PCBs.

In conclusion, analytical results of all samples collected at the site indicate that the PCB contamination is confined to the top two feet of soil and is within the area shown on Figure 2-2. This constitutes a volume of approximately 2400 cubic yards of contaminated PCB soils that may exceed the cleanup criterion of 25 ppm PCB.

The TCE is concluded to be present in the groundwater only, and remediation of this material is being performed as a TWC-managed project.



- LEGEND
- ZONE OF KNOWN CONTAMINATION (ZOKC)
 - ZONE OF POTENTIAL CONTAMINATION (ZOPC)
 - BOUNDARY OF THE WASTE MANAGEMENT UNIT
 - SAMPLE LOCATIONS AND RESULTS IN PPM

FIGURE 2-2

ENSR ENSR CONSULTING AND ENGINEERING		
WASTE MANAGEMENT UNIT INDUSTRIAL TRANSFORMER SUPERFUND SITE HOUSTON, TEXAS		
DRAWN BY: SJ CHECKED BY:	DATE: 2/13/90 REVISION: 3-18-91	PROJECT NUMBER: 9504-002-003

3.0 SCOPE OF WORK

Remedial actions for the ITS Site will involve completing multiple activities in a pre-selected sequence. The sequence is designed to accomplish coordination of those activities, within the limited space available on the site. The sequence is also designed to allow control and minimization of the remediation project's impact on the surrounding community and environment.

The list of remedial activities to be implemented is shown in Table 3-1; the field activities involved in each of the activities are described in the following paragraphs.

3.1 Tenant Access

Prior to on-site remediation activity, the Discount Communications Company access route will be revised to provide employee and customer access to their business during site remediation. Temporary access will be provided by installing a new door in the east side of their building and providing access from the front of their facility. Parking space will also be provided on the east side of their building, as well as in front of the adjacent building to the east. Appropriate revisions to the internal wall structure in their building will be installed to allow their business to operate through the new, temporary vehicle entry door. A 6-inch pipe bar will be installed to provide a security barrier for the new door.

After completion of the new temporary entry, the three doors in the rear of the building will be closed, locked, and sealed with duct tape for the duration of the remedial activities. An earthen dike will be installed along the outside of the back wall of the building to assure that rainwater cannot run into the building from the ITS Site.

After final site remediation verification by EPA, the currently existing doors will be unsealed and reopened for use. The temporary access door will be removed, and the building restored to its current arrangement. In addition, the access route and parking area behind the building will be restored to their current level of parking and access provisions.

TABLE 3-1

**INDUSTRIAL TRANSFORMER SITE
REMEDIAL ACTIVITIES LIST**

1.	Provide Tenant Temporary Access Facilities
2.	Provide Site Security Fencing
3.	Remove Existing Temporary Facilities
4.	Install Decontamination/Rainwater Storage Tanks
5.	Perform Rock and Non-Earthen Material (RNEM) Remediation
6.	Install Water Treatment Facilities
7.	Perform Site Pretreatment Excavation and Remediation Verification
8.	Perform Site Preparation Activity, Preparing the Facilities to Allow Mobilization of the Dechlorination Treatment Facilities
9.	Mobilize Dechlorination Treatment Facilities
10.	Complete Performance Test Run of Dechlorination Treatment Facilities
11.	Perform Dechlorination Treatment of Contaminated Soils
12.	Perform Final Site Excavation and Remediation Verification (Under the Contaminated Soil Building)
13.	Perform Treated Soil Stockpiling and Remediation Verification
14.	Demobilize the Dechlorination Treatment Facility
15.	Demobilize Remediation Support Facilities
16.	Complete Final Site Grading and Restoration to Original Arrangement

3.2 Site Security

A 6-foot cyclone type wire mesh fence will be installed to maintain site security during the remediation activities.

The gates will be kept locked at all times when the site is not attended by project personnel, and will be kept closed at all times except when in use, when project personnel are on site.

Once the APEG dechlorination treatment facilities are mobilized, the site will be staffed 24 hours/day, 7 days/week until demobilization is completed.

3.3 Existing Temporary Facilities Removal

After providing for Discount Communications Co. to use temporary entrance facilities, all existing temporary road mats and plastic ground cover will be decontaminated and removed. These items will be washed with a high-pressure water gun to achieve decontamination. A temporary decontamination pad will be used to collect decontamination wastewater. The matting and plastic sheeting will be sampled and analyzed for hazardous waste characteristics (including PCBs) in accordance with Project QA plans, and transported to an off-site RCRA or municipal landfill for disposal, depending on the analysis results.

3.4 Rock and Non-Earthen Material Remediation

Rock and Non-Earthen Material (RNEM) is defined as all concrete, plastic, glass, vegetation, etc., that is not soil, and is present at the site. All RNEM will be collected, sampled and analyzed for PCB concentration, and transported off site for disposal.

The sequence of accomplishing this remedial activity is as follows:

- The boundary of the Waste Management Unit (WMU) will be staked-out to identify the area where PCB remediation is required. The boundary will be identified by locating and staking the site remediation verification grid. The grid drawing will be scaled from the grid lines to locate a stake on the WMU Zone of Potential Contamination (ZOPC) boundary at 10-foot intervals around the entire WMU perimeter.

- All surface RNEM outside the WMU and within the area needed for project activities will be collected and transported off site to a municipal landfill for disposal. This will include all aboveground vegetation.
- All aboveground vegetation inside the WMU boundary will be manually cut and collected. Care will be taken to not let the vegetation contact the ground surface. This material will also be transported to an off-site municipal landfill.
- A wastewater storage tank will be mobilized to the site, and a temporary decontamination pad constructed. The connection to the City of Houston water supply will be installed to provide a clean water source for high-pressure water washing. The temporary decontamination pad will consist of a diked area lined with hypalon plastic sheeting. A pump will be provided to move collected decontamination wastewater to the wastewater storage tank. Accumulated wastewater will be retained in storage until the wastewater treatment facility is installed and the NPDES/TWC surface water discharge permits are received. The accumulated wastewater will then be processed through the water treatment plant, and discharged from the site in accordance with permit requirements.
- All RNEM inside the WMU boundary will be collected, decontaminated with a high-pressure water wash, and stockpiled on site for sampling and analysis to determine PCB concentration. The RNEM will then be transported off site for disposal at an approved landfill (RCRA or TSCA) as required, based on the PCB concentration analysis results.

As this RNEM collection activity is performed, the areas inside the WMU boundary where the soil is disturbed will be wetted to assure that no dust is disturbed. The activity will not be performed during a precipitation event or when the site is excessively wet.

3.5 Water Management

Decontamination water and some of the site's stormwater runoff have the potential to be contaminated during remediation activities at the ITS Site. The APEG-Plus™ dechlorination process does not generate process wastewater.

Decontamination water will be collected in sumps provided in the decontamination area and pumped to the water treatment facility. The water treatment system will be installed prior to the start of excavation activities. Decontamination showers will be pumped

directly to the treatment system. All decontamination occurring during the RNEM surface remediation will take place within a temporary equipment decontamination area. The decontamination water will be pumped to an on-site storage tank to be held for subsequent treatment.

During the pretreatment excavation sampling events, the WMU surface soil will be covered with plastic sheeting to prevent rainfall from contacting the ground surface. Accumulated rainwater on top of the plastic sheeting will be drained or pumped directly to the surface water drainage ditch around the site, and will not require storage and treatment.

During implementation of the APEG-Plus™ dechlorination treatment activity, stormwater will be collected and contained in areas having a potential for containing PCBs. Stormwater runoff will be collected from areas surrounding the soil treatment equipment, the feed mixing area, and the wastewater treatment plant. This water will be collected in sumps and pumped to one of the several holding tanks for analysis and/or treatment.

The untreated soil stockpile will be contained under a building roof and will not generate contaminated stormwater runoff. Stormwater runoff from other areas such as the office trailers, treated soil stockpile areas and auxiliary support equipment will also not be collected or treated. This non-contaminated stormwater will be routed around the site into the existing city stormwater ditch.

Water Treatment

A water treatment plant is provided for the ITS Project, to remove PCBs in accordance with the *Consent Decree requirements*. All discharged water will contain less than or equal to 1 µg/L total PCBs. In addition, because the source of water to be treated is stormwater runoff and decontamination washwater, discharge criteria are also established for the following parameters:

- Total Suspended Solids (TSS)
- Chemical Oxygen Demand (COD)
- Oil and Grease
- pH

Untreated the runoff water and washwater may contain high levels of suspended solids due to site construction activities. The excavation will disturb the existing seeded topsoil resulting in soil and mud being carried away via heavy equipment and personnel traffic.

These solids will be retained in the decontamination washwater and removed by the treatment system.

The discharge criteria include COD, oil and grease, and pH because these parameters are typically required by the Texas Water Commission for stormwater discharges.

The proposed effluent water quality criteria which will be met by any of the above described waste waters discharged to the off-site drainage ditch is as follows.

<u>Parameters</u>	<u>Units</u>	<u>Maximum Value</u>
Total PCBS	µg/L	1.0
TSS	mg/L	45.0
COD	mg/L	200.0
Oil & Grease	mg/L	15.0
pH	std. units	6-9

These final effluent water quality criteria will be established by the approved NPDES and TWC Water Discharge Permits (See Section 2.2.6 and 2.2.7, and Appendix G). All water that has contacted the WMU, or the treatment portion of the APEG-Plus™ process will be discharged in accordance with these permits requirements.

3.6 Pretreatment Excavation and Remediation Verification

The pretreatment excavation remedial action will consist of the following sequence of activities to be performed after completion on the RNEM remediation activities.

- The surface of the WMU will be manually scraped to remove and collect the top 1-inch surface layer of soil. This activity will be performed by hand, using hoes, shovels, and rakes. The excavated material will be placed in the contaminated soil building within the WMU while awaiting treatment.
- A complete remediation verification sampling and analysis event will be performed to determine PCB concentration at each remediation verification grid sample location. Samples will be composited from a 0- to 6-inch depth, covering sufficient area to obtain the required sample volume. These activities will be performed in accordance with sampling and analysis procedures described in the Quality Assurance Plan, and the Remediation Verification grid described in Appendix C of the Design Report - Volume I.

- In accordance with the Consent Decree Statement of Work, any grid square that has the sample on any of its four corners report a PCB concentration of >25 ppm will be remediated by excavation of additional soil from that grid square. To determine the grid square size to be excavated, GSU may elect to collect additional samples from a smaller grid interval that is centered on the original sample location that reported >25 ppm PCB.
- The sequence of performing a pretreatment excavation event, followed by a remediation verification sampling event, will be continued until all areas of the WMU report PCB concentrations of ≤ 25 ppm.

Each pretreatment excavation step will be performed in accordance with written instructions prepared prior to performing the work. The plan will be available at the site for review by the EPA oversight representative prior to implementation at their request. Upon request, any sample will be split with EPA for their analysis.

During these pretreatment excavation steps, the WMU surface soil will be covered with plastic sheeting to prevent windblown dust from leaving the site. When a portion of the WMU is uncovered to allow work to be performed, the exposed surface soil will be maintained in a wetted condition to prevent windblown dust from leaving the area. At the end of each work day, the WMU area will be totally covered with plastic to prevent rainfall from contacting the ground surface. Accumulated rainwater on top of the plastic sheeting will be drained directly to the surface water drainage ditch around the site. If necessary, as excavation of the site progresses, rainwater that accumulates in low spots on top of the plastic will be pumped out of the low spot and allowed to follow natural drainage off site.

Immediately upon receiving EPA concurrence of the remediation verification results on the WMU area outside the contaminated soil building, the entire site outside the building will be graded to comply with the elevation requirements for the interim site arrangement required during the soil treatment phase of the project. If necessary to establish the required elevations and natural drainage, clean soil will be moved from the west end of the site property, or clean soil will be imported from off site.

3.7 Site Preparation

The site preparation activities will be performed upon completion of remediation excavation and consolidation of the excavated soils into the contaminated soils building.

These activities will prepare the site for the dechlorination treatment phase of the project, and will consist of the following:

- Completing site perimeter fencing revisions to provide the interim site arrangement specified for the dechlorination treatment phase of the project.
- Installing the electrical power feed system from Houston Lighting and Power Company (HL&P) to the site meters.
- Constructing the following:
 - dechlorination treatment process area pad,
 - contaminated soil screening/mixing area pad,
 - chemical unloading and storage area pad.
- Installing the water supply connection to the City of Houston's water header.
- Modifying existing monitor wells to provide for manholes at ground surface, and to eliminate aboveground protrusion of the well casing and cover.

Completion of these activities will allow mobilization of the APEG dechlorination treatment facilities to be performed.

3.8 APEG Dechlorination Treatment

The dechlorination treatment of the contaminated soils will be performed utilizing Galson Remediation Corporations (GRC) mobile, modular dechlorination treatment unit capable of processing 28 to 42 tons of soil per day. This process consists of the following steps.

Soil Preparation

Contaminated soil, screened to 6" size, is removed from a stockpile (provided by the prime contractor) with earth-moving equipment and passed through a 6-inch bar grate into a soil shredder. After shredding, the material falls onto a covered weighing conveyor and is conveyed into a modified sludge mixer. A site appropriate quantity of reagent (100% by weight for the ITS project) is added to the mixer where the soil and reagents are blended into a workable slurry. Once mixed, the slurry is passed through a series of sizing screens where material greater than one quarter inch is separated out for rock washing. The screened slurry is then pumped to one of the two reactors.

Reaction

Once loaded into the reactors, the soil/reagent mixture is heated and agitated until contamination has been reduced to 25 ppm or less (clean level). A slight vacuum is maintained on the vessel to prevent contaminants from escaping the system. Slurry soil samples for analysis are taken directly from the reactor vessel by an automatic sampler during the reaction to determine when the clean level has been reached. The samples are analyzed for contamination by the on-site laboratory.

Steam from the reactor is condensed. Any "light or "heavy ends" will be separated out of the condensate and treated or shipped off-site for disposal. Recovered water is cycled back into the system via two possible uses: rock washing water to rinse the oversized material, and/or quench water for cooling the reslurry in the reactors. Volatiles are trapped in a carbon filter which is sent off site for disposal.

Quench water is pumped slowly into the reacted soil to cool the mass to approximately 200°F via flash cooling. The soil is neutralized to a site specific pH by addition of an appropriate quantity of acid. Acid will be added to the quench water or directly inserted into the reactor.

Major pieces of equipment utilized in the reaction process include:

- Two ASME code reactor vessels with an approximate capacity of 3,000 gallons. Both are rated for full vacuum and up to 40 psig. The vessels have hot oil jackets for heating.
- Agitators for each reaction vessel.
- Vacuum pump to maintain a vacuum on the reactor and the condenser.
- Shell and tube heat exchangers to condense steam from each reactor.
- Condensate collection tank and transfer pump for each condenser.
- One condensate treatment tank for both condenser systems. This tank is located off the trailer.
- Electrical and programmable logic controller (PLC) control panels containing breakers and PLC interface specific to the reactor trailer.

Separation/Reagent Removal

When the reaction is complete, and it has been verified that contamination has been reduced to the acceptable "clean level," the reagent must be separated from the soil. The soil slurry is pumped out of the reactor into the centrifuge where the liquids are removed from the soil. The chemicals used in the reaction process are water soluble. Further removal of reagents is accomplished by washing the soil with water. After initial separation of reagents, the soil is reslurried with washwater and sent to a slurry tank for holding and mixing. The slurry is then recentrifuged for additional reagent removal.

The major pieces of equipment utilized in the centrifugation process include:

- Two trailer mounted Bird 36" x 96" horizontal solid bowl decanter centrifuges with a G force of approximately 400 Gs.
- Reslurry and slurry tanks with appropriate sized mixers.
- Conveyors to remove soil from the solids end of the centrifuges and to discharge clean soil from the process.
- Electrical and PLC control panels containing breakers and PLC interface specific to each centrifuge trailer.

Reagent Recovery

The reagents used in the process are recycled for use in consecutive batches. For the reagent to be further utilized in the treatment process, water added during treatment must be separated. Reagents removed in the separation process are sent to the reagent recovery system. A triple effect evaporator system is used to concentrate the reagent to concentration levels based on project specifications. Refortification of the reagent will be necessary when reagent (especially KOH) is absorbed by soil components, or neutralized.

The major pieces of equipment utilized in the reagent recovery process include:

- Triple effect evaporator.
- Heat exchangers, distillation columns and pumps.
- Tanks for dilute reagent and condensate storage.

- Electrical and PLC control panels containing breakers and PLC interface specific to the reagent recovery trailer.

Volatiles Treatment

Steam generated from the evaporation process is condensed and recycled as quench water or rock washing water. Any volatiles are pulled off and treated by appropriate means. Site specific design of this system is currently under development. One example would be to treat the emissions with dry carbon or coated carbon to capture sulfur-containing compounds (i.e., DMS) for odor control.

Clean Soil

Decontaminated soil is discharged from the centrifuge onto a conveyor and stockpiled according to site specifications. In all cases, processed soil will be stored daily in a linear pile on the clean soil staging area. The prime contractor will cover the soil piles daily to provide weather protection.

Support Equipment

Heating:

Reaction and reagent separation both require a heat supply. Heat is generated by a fuel oil-fired hot oil boiler located on the heater trailer. The boiler is rated at ten million British Thermal Units (Btu) output. The boiler heats a heat transfer fluid (HTF) which is then pumped through a distribution system to the jackets of the reactors and the primary heat exchanger in the reagent recovery system. The boiler unit temperature controller monitors and maintains a "constant" HTF temperature.

Cooling:

The Reaction and Reagent Recovery process requires a "cooling" system for condensing steam and cooling the condensate. The glycol cooling system circulates a mixture of water and ethylene glycol through a series of heat exchangers and air coolers. Appropriate temperature is maintained by controlling the flow of coolant through the air coolers.

The cooling system is designed to fill a dual purpose. Since normal operating temperature of the coolant is higher than the freezing points of water and the reagents,

the waste heat in the "coolant" can be used to keep these liquids from freezing during winter operations. The tanks on the tank trailer are jacketed for this purpose.

Electrical/Control:

Electrical supply is distributed through a mobile electrical substation. The substation has a capacity of 3,000 amps at 480 volt three phase power. It is capable of distributing 480 volt and 120/208 volt power via plug-in cables to the trailers and other process equipment.

The trailer also contains the control room which is the center for all process operations. The control room contains the PLC operators control panel, communications controls and video surveillance equipment. Through the PLC, the control room operator can control the process equipment, monitor the status of the process, and respond to alarm situations. From this station the operator will communicate with field personnel via two-way radio and visually monitor operations through the video surveillance equipment.

3.9 Final Site Remediation

The contaminated soil will be removed from the contaminated soil building starting from the west end, and working eastward. As the excavated soil is removed, the soil forming the floor of the building will be sampled at the site remediation verification grid locations.

The sequence of an excavation step followed by a remediation verification sampling/analysis event will then be followed in the portion of the site that was not excavated previously (i.e., the soil under the contaminated soil building).

The normal 25-foot remediation verification sampling grid will be revised to the following grid, for remediation verification sampling inside the contaminated soil building. Three rows of samples on 10-foot intervals will be taken down the east-west length of the building. One row will be down the middle of the 30-foot wide building, and a row will be taken 3-feet in from each side of the building (See Appendix C).

This final excavation remediation activity will be performed until PCB concentration in the area under the building is ≤ 25 ppm.

3.10 Treated Soil Stockpiling and Remediation Verification

The treated soil removed from the APEG dechlorination treatment process will be stockpiled in the processed material staging pad. The stockpile will be shaped into a continuous long, slender pile. It will be placed on top of plastic sheeting, and also covered with plastic sheeting to prevent the treated soil from being rain washed out of the stockpile.

Remediation verification of treated soils will be performed as follows:

- One sample will be obtained from each 7-cubic-yard APEG-Plus™ treatment batch when the soil is discharged from the treatment plant centrifuge.
- The treated soil will be moved to the stockpile and marked with a flag denoting the batch number.
- After samples are collected from seven batches, an aliquot will be taken from each sample, and the aliquots will be composited and analyzed.
- Out of the seven samples, one will be chosen randomly and analyzed separately.
- This sampling and analysis procedure will be repeated for every group of seven batches until soil treatment is completed.

Sampling will be performed in accordance with procedures specified in the Consent Decree Statement of Work. Each sampling event will be scheduled with the EPA oversight representative to allow him the opportunity to be present, and the opportunity to split samples should that be required.

3.11 APEG Demobilization

Upon receipt of EPA approval of remediation verification for the entire site, the APEG treatment facilities will be decontaminated in accordance with procedures described in the Remedial Design Report - Volume II - Soil Dechlorination Treatment Facility, and demobilized from the site.

3.12 Remediation Support Facilities Demobilization, and Final Site Grading

After APEG dechlorination treatment facilities are demobilized, the following activities will be performed to demobilize remediation support facilities and finalize site condition.

- All remaining project facilities will be removed from the site, including the office trailers, water treatment facilities, water storage tanks, telephones, electrical power connections, city water connection, the contaminated soil building, etc.
- The treated soil stockpile will be spread and compacted on the former WMU, and the overall site ground surface shaped to finish grade design.
- The site fence will be modified to comply with the final site fence design.
- The Discount Communications rear entry driveway parking area will be constructed in accordance with the current design, or such other design as the tenant, the owner, and Gulf States may agree upon. The three rear doors will be unsealed and reopened for use.

3.13 Ambient Air Monitoring

The influence of ITS Site remediation activities on the ambient air will be monitored by means of an air monitoring program. The program will consist of sampling the air at the fenceline downwind of the active remediation. High volume air samplers will collect particulates on a filter. The samples will be analyzed for total particulates and for PCBs. A series of background samples will be obtained prior to the start of activities on site to aid in the interpretation of analytical results.

The local weather bureau will be contacted daily to record in the site logbook, the Houston area high and low temperature, and barometric pressure for each day.

The equipment used will consist of a meteorological station with instruments for continuous measurement of wind speed, and wind direction, and two General Metal Works PS-1 samplers with filters in sandwich cartridges, and two General Metal Works TSP High Volume (Hi-Vol) samplers with 8"x10" glass fiber filters. Prior to each sampling event, the wind direction will be determined and the two samplers will be positioned at the fenceline downwind of the site. Samples will be obtained over an 8-to 10-hour period covering the working day, or other appropriate time period. One sampler will contain a glass fiber filter; the particulates collected on this filter will be analyzed for total

particulates. The other sampler will contain a XAD-2/PUF filter; the particulates and vapors collected on this filter will be analyzed for PCB content. The sampling and analytical methods used for analysis are detailed in the Quality Assurance Project Plan.

During the 3 weeks prior to the start of site surface remediation-implementation of the Rock and Nonearthen Materials Management Plan, four 24-hour samples will be obtained. This will be performed in the same manner as sampling during active remediation. The analytical results of the sampling prior to commencement of on-site activities will be used to identify normal background values for particulates and PCBs in the ambient air.

After the start of excavation activities, ambient air sampling will be conducted 2 days per week. Analytical results will be presented to the EPA in the monthly reports.

The air monitoring results for the first four nuisance dust data points will be reviewed to determine whether upwind samples are needed.

3.14 Waste Management

The following wastes will be generated during the ITS Site remediation:

Rock and Non-Earthen Materials - includes surface vegetation, rocks, plastic from removal of temporary driveway.

Dry Waste and Debris - includes respirator cartridges, Tyvek® clothing, gloves, rocks, and small items contaminated with untreated soil.

Laboratory Wastes - mainly liquids generated in small amounts during on-site process control analyses. Includes caustic liquids, flammable and other solvents, dry debris, and acidic liquids.

Waste Reagent - mixture, primarily liquids remaining in process equipment at the end soil treatment. This material may contain chlorinated byproducts, salts, dimethyl sulfide, organic chemicals, and soil fines.

Residual Product - mixture, primarily solids, removed from reagent recycle stream. This material may contain chlorinated byproducts, salts, dimethyl sulfide, organic chemicals, and soil fines.

Washwater - water generated during a rinse of the dechlorination equipment during the final decontamination.

Sludge - generated during wastewater treatment.

These wastes will be handled and disposed of as shown below. For additional detail of these procedures see Section 3.1.14 in the Design Report - Volume I.

Rock and Non-Earthen Materials

Rock and nonearthen materials (RNEM) from outside the waste management unit (WMU) will be collected in an area outside the WMU and transported off site to a municipal landfill. RNEM from inside the WMU will be collected in an area inside the WMU and tested in accordance with the Rock and Nonearthen Materials Management Plan. The materials will be disposed of in a TSCA-approved landfill, a RCRA-approved landfill, or an industrial or municipal landfill, depending on the concentration of PCBs in the materials. The surface rock and nonearthen materials will be removed from the site before any excavation begins.

Dry Waste and Debris

The waste will be accumulated in drums at the two decontamination areas and in the laboratory. Drums of discarded personal protective equipment from the decontamination areas will be placed in or adjacent to the contaminated soils building to be included in the consolidation of PCB contaminated wastes. These drums will be sampled and disposed of in a TSCA-approved landfill, a RCRA-approved landfill, or an industrial or municipal landfill, depending on the concentration of PCBs contained in the waste.

Laboratory Wastes

Laboratory wastes will be accumulated in the laboratory in drums or pails separated according to waste type, (i.e., acidic, basic, chlorinated, or flammable). These wastes will be generated in small amounts. They will be fully characterized, if necessary, at the termination of this project and properly disposed of at that time. Incineration will be the preferred disposal method.

Waste Reagent and Residual Product

These wastes will primarily be generated at the end of the soil treatment activities. Some residual product may need to be purged from the APEG process reagent tank during the treatment period. These wastes will be fully characterized, to determine the appropriate disposal method. It is anticipated that these wastes will be incinerated at a RCRA-approved facility.

Washwater

The final APEG process equipment decontamination washwater will be pumped to one of the holding tanks in the wastewater treatment system. The water will be tested for the presence of reagent chemicals (dimethyl sulfoxide, Dowanol TMH glycol ether, and polyethylene glycol-400). If detectable concentrations of these chemicals are present, the water will be held in the tank, analyzed for PCB concentration, and a specific disposal plan for this water will be prepared, submitted for EPA approval, and implemented. If detectable concentrations of these chemicals are not present, the water will be processed through the site water treatment system and discharged in accordance with the NPDES and TWC discharge permits.

Sludge

The sludge generated at the wastewater treatment plant is composed of dirt particles that settle out, and flocculent added to reduce the solids in the water. This sludge will collect in the holding and treatment tanks of the water treatment system. It is not anticipated that this sludge will be removed prior to the final demobilization of the water treatment system. At that time the sludge will be analyzed for PCBs. Based on the PCB content, the sludge will be transported to a TSCA-approved PCB landfill, a RCRA-approved landfill or a municipal landfill for disposal.

All wastes shipped off site will be properly manifested. An initial notification of waste generation for this site will be submitted to the Texas Water Commission.

4.0 HAZARDS

This section identifies potential hazards that may be encountered during the ITS Site Soil Remediation Project. The protective measures to be implemented during the project to assure detection and control of potential health and safety hazards are described in the remainder of this health and safety plan.

4.1 Chemicals Characteristics

Chemical hazards at the Industrial Transformer site are related primarily to the presence of polychlorinated biphenyls (PCBs) in contaminated soil, and to process reagents utilized in the APEG treatment process. An MSDS for PCBs will be maintained at the site.

The ITS site remedial investigation also reported that trichloroethylene (TCE) had been used at the site and is primarily present in the groundwater. Negligible concentrations were reported in the soils with the PCBs. However, during the soils remediation project health and safety precautions will be taken to verify that the potential for TCE exposure is monitored and controlled.

PCBs

Skin Contact: PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

Eye Contact: The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion: The acute oral toxicities of the undiluted compounds as reported by Monsanto are: LD₅₀ rats--8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated--"slightly toxic."

Inhalation: Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42%

chlorinated material. At normal ambient temperatures, PCBs are not very volatile and inhalation of vapors is not a likely route of exposure.

Other: There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies with PCBs is that they produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by the exposures that produce liver injury are less than those reported to cause cancer in rodents.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any statistically significant causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. Nor was there any increase in overall cancer mortality as a result of PCB exposure. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1982) Group 2B and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Third).

The permissible Exposure Limit (PEL) established by OSHA for inhalation of PCB vapor is 1.0 mg/m³ concentration for an 8-hour time-weighted average (TWA) exposure. The PEL for PCB (54% chlorine) is 0.5 mg/m³ (TWA).

Trichloroethylene (TCE)

Inhalation: The primary route of exposure to TCE is inhalation of vapors. TCE is primarily a central nervous system depressant. Inhalation may cause fatigue, vertigo, dizziness, headache, memory loss, inability to concentrate, and gastrointestinal disturbances.

Skin Contact: TCE is mildly irritating to the skin. Repeated contact may cause chapping and removal of natural fats and oils.

Eye Contact: Direct eye contact produces injury to the corneal epithelium; recovery usually occurs within a few days.

Ingestion: Ingestion may cause nausea, vomiting, and loss of consciousness.

Other: Some experiments with test animals have indicated that this substance may be carcinogenic in those animals. No evidence of teratogenic effects has been seen in rodent assays. In humans, no evidence has been observed of an increased incidence of adverse affects in the offspring of female TCE-exposed workers.

The permissible exposure limit established by OSHA for TCE is a 50 ppm concentration for an 8-hour time-weighted average exposure.

Reagents

Chemical hazards associated with reagents used in the APEG process involve potential exposure to corrosive caustics and other reagents. Leakage from process equipment presents the possibility of personnel injury in the immediate vicinity of the leak. Contact with skin or eyes may cause severe irritation or burns.

Material Safety Data Sheets (MSDSs) will be maintained on site for all reagents. Copies of MSDSs for PCBs, laboratory chemicals, reagents, fuels, and other materials listed below are included in Appendix A. The following reagents and chemicals are utilized in the APEG dechlorination process:

- potassium hydroxide (KOH),
- polyethylene glycol 400 (PEG 400),
- triethylene glycol monomethyl ether and higher homologs (TMH),
- dimethyl sulfoxide (DSMO),
- sulfuric acid,
- ethylene glycol,
- paratherm (mineral oil), and
- diesel fuel/fuel oil.

4.2 Identification of Potential Hazards

To establish an understanding of facilities design and field work practices necessary to control potential health and safety hazards on the ITS Site Soil Remediation Project, it is first necessary to identify those potential hazards.

This section identifies the primary potential hazards anticipated during the project. Other sections of this health and safety plan describe the methods, procedures, and protective measures to be taken during the project to assure potential hazards are properly controlled. Identified potential hazards are listed below.

- Dust or process chemical contact with eyes.
- Ingestion or inhalation of vapor from contaminated soil or process chemicals.
- Excessive or prolonged skin contact with contaminated soils.
- Skin contact with process chemicals.
- Strains while lifting.
- Thermal burns through contact with hot process equipment.
- Cuts/punctures through contact with mechanical objects.
- Electrical shock.
- Excessive noise exposure.
- Slips/trips/falls over obstructions.
- Heat stress.
- Struck/pinched by moving equipment.

5.0 STANDARD OPERATING PROCEDURES

The requirements of this Health and Safety Plan are designed to define the special requirements of this project. Any deviation from established procedure or from this plan must be approved by the General Project Manager.

The Field Operations Manager is responsible for ensuring compliance with all of the requirements of this plan.

The Site Health and Safety Officer (SHSO)/Site Superintendent is responsible for advising the Field Operations Manager, and assisting in interpreting the Plan and making measurements and evaluations called for in the Plan. In addition, the Health and Safety Officer is responsible for assuring that all field activities comply with this plan. He will immediately bring to the attention of the Field Operations Manager any deviation. In the absence of the Site Health and Safety Officer, the Field Operations Manager will function in this assignment.

Site health and safety inspections will be completed by the SHSO daily, with follow-up inspections as necessary.

Safety meetings will be held prior to the start of work each day. These meetings will cover new or changed procedures, special precautions, new information, and any trends or observations.

All accidents, injuries, and near misses will be investigated as described in Section 7.8. The preliminary report form (see Table 7-2) will be used to record information on the incident and investigation results. This will include determining how the accident, injury, or near miss occurred and what can be done to prevent a reoccurrence or make operations safer. The accident investigation will involve the Site Health and Safety Officer, the Field Operations Manager, the Site Remediation Manager, and the General Project Manager.

The Site Health and Safety Officer will maintain a daily log book. The log book will be used to record attendance and subjects of safety meetings, time and date of inspections made, results of any inspections, and other pertinent health and safety activities. Information related to any project accidents, injuries, or near misses will also be recorded in the log book.

Activities will be conducted in a manner that minimizes the opportunity for exposure to physical and chemical hazards. The primary chemical hazards that may be encountered are inhalation of PCB containing dust, and skin contact with APEG Unit caustic reagent. Dust suppression methods such as wetting and covering soil with plastic will be employed to control dust generation. Appendix D, in the Remedial Design Report, Volume I - Site Remediation and Preparation for Treatment, describes detailed soil handling and stockpiling procedures.

6.0 MEDICAL SURVEILLANCE

Prior to beginning field work, and after completing work at the Industrial Transformer Superfund (ITS) Site, each individual (employee, contractor, or subcontractor) will be required to receive a medical examination in accordance with OSHA 29 CFR 1910.120(f). All medical records are confidential between the individual and his employer, and will not be accessible by others without the individual's consent.

6.1 Who Receives Medical Examination?

The following guidelines describe who will be required to receive a medical examination.

- Each individual, who will be working inside the site Exclusion Zones for 30 days or more, will be required to receive a medical examination prior to beginning field work.
- Each individual who has completed work at the ITS site, and has worked at the site for 30 days or more, will be required to receive an exit medical examination.
- Each individual who, in the course of performing work at the site, is injured due to overexposure from an emergency incident involving hazardous substances or health hazards will receive a medical examination appropriate for the exposure involved immediately after the incident, and repetitively as required by the medical examiner.

Medical examinations specifically for the ITS site remediation project work will not be required for:

- individuals whose employers already require them to participate in an OSHA 29 CFR 1910.120(f) hazardous waste site work annual medical examination program;
- individuals who will work at the site for less than 30 days;
- individuals who will work at the site for more than 30 days, but will not have clearance to enter a site Exclusion Zone; and
- site visitors.

6.2 Medical Work Clearance

Before any individual (employee, contractor, or subcontractor) who is required to receive a medical examination may perform work at the site, his/her employer must provide the Field Operations Project Manager with a completed Employer Medical Exam Verification Form (see Table 6-1 or use other form containing same information).

This form is the employer certification that his listed employees are in compliance with the ITS site project medical examination requirements.

6.3 Medical Examination Content

The medical examination required prior to beginning work at the ITS Site will include, at a minimum, the examination steps and tests listed in Table 6-2. This list specifies the minimum requirements. The individual's direct employer is responsible for specifying other tests the employer may require.

It is suggested the employer require:

1. The employee to indicate his consent to receive the medical exam by completing and signing an Employee Medical Surveillance Consent Form. (An example of such a form is shown on Table 6-3.)
2. The examining physician to complete a work clearance form. (An example of such a form is shown on Table 6-4.)

This examination evaluates each individual for his fitness to work while wearing a respirator. A respirator fit test will be performed at the project site by the SHSO and the individual will be trained in the proper use of a respirator, before they are allowed to work in the Exclusion Zone.

Additionally, each individual is evaluated for his fitness to work while wearing chemical protective clothing including rubber gloves and boots, safety glasses, face shield, and Saranax plastic coveralls. The individual will be trained at the site, in the potential for heat exhaustion, its symptoms, and its prevention while using this type equipment (see Section 8.3).

Medical records relating to the ITS project will be maintained for 30 years by all parties involved in the project (per 29 CFR 1910.20).

TABLE 6-1

**EMPLOYER MEDICAL EXAMINATION AND
HAZARDOUS WASTE SITE TRAINING CERTIFICATION**

To: Field Operations Project Manager

Date: _____

This is to certify that the following listed employees of my company have received the indicated preparation for work at the Industrial Transformer Superfund Site.

Name	Medical Exam	40-Hour Training	24-Hour Training	8-Hour Retraining
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
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_____	_____	_____	_____	_____
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_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Please Print Company
Name, Address, Telephone

_____ Zip _____

() AC _____

Certified by:

_____ Signature _____

_____ Title _____

TABLE 6-2

MEDICAL SURVEILLANCE PROGRAM
EXAMINATION CHECKLIST

Employee Name: _____

Social Security #: _____

Date of Examination: _____

Type of Examination: Baseline/Annual/Exit/Emergency Incident (please circle)

Please check the appropriate boxes to indicate the components of the medical examination completed:

No Yes

<input type="checkbox"/>	<input type="checkbox"/>	Employee Consent Form
<input type="checkbox"/>	<input type="checkbox"/>	Medical History Questionnaire
<input type="checkbox"/>	<input type="checkbox"/>	* Work/Exposure History Questionnaire
<input type="checkbox"/>	<input type="checkbox"/>	* Physical Examination (including vision)
<input type="checkbox"/>	<input type="checkbox"/>	* Spirometry (Pulmonary Function) Test
<input type="checkbox"/>	<input type="checkbox"/>	* Blood Chemistry Panel (e.g., SMAC-20)
<input type="checkbox"/>	<input type="checkbox"/>	* Complete Blood Count
<input type="checkbox"/>	<input type="checkbox"/>	Serum PCB, RBC Cholinesterase, Blood Pb
<input type="checkbox"/>	<input type="checkbox"/>	* Urinalysis (including drug screen)
<input type="checkbox"/>	<input type="checkbox"/>	* Audiogram
<input type="checkbox"/>	<input type="checkbox"/>	Electrocardiogram
<input type="checkbox"/>	<input type="checkbox"/>	Chest X-ray (single view)

☐ ☐ _____ Medical Clearance Form

All components listed above are to be completed during the employee's initial baseline medical examination, and when required, during the examination at termination. Those components marked with an * are to be completed at the time of each annual surveillance examination taken between the initial and termination exam. The physician may add, or may be requested to add, additional tests depending upon the exposure history of the employee being examined.

Please check the appropriate boxes to indicate copies of forms or records sent to the Field Operations Project Manager:

☐ ☐ _____ Copies of Consent, Clearance and Checklist forms sent to Field Operations Project Manager.

TABLE 6-3

(Example Form)

**MEDICAL SURVEILLANCE PROGRAM
EMPLOYEE CONSENT FORM**

Name: _____

I understand that my employer, _____, must be informed about my medical suitability for work with hazardous materials, and that the examining physician will send a report to my employer stating whether I am, or am not a suitable candidate for this work. I also understand that I will receive a copy of any communication relating to my health sent to my employer.

I understand that any and all occupationally related medical information gathered during examinations performed may be made available to my employer or his Designated Medical Consultant so that the physician's performance may be evaluated. Other than this case, all personal health information I supply, plus specific results of any examinations that may be performed as a part of my employer's Medical Surveillance Program will be kept confidential and cannot be released without my expressed consent.

I also understand that while this examination may be viewed as a comprehensive physical examination, it has been designed as an occupational health examination, and should therefore not be substituted for a general physical examination performed by my personal physician.

Signed: _____

Dated: _____

Witness: _____

☐ Please send a copy of the results of my medical examination to my employer at the address listed below:

☐ I do not wish to have a copy of my medical examination results at this time.

TABLE 6-4

(Example Form)

**MEDICAL SURVEILLANCE PROGRAM
PHYSICIAN'S CLEARANCE FORM**

On _____, I performed a baseline/annual Exit/Emergency Incident (please circle)

medical examination on _____ in accordance with the requirements of the Industrial Transformer Project Medical Surveillance Program. All of the medical examination components specified on the enclosed checklist were performed at that time. Based on this examination, I certify that the above named individual is:

- ☐ cleared to perform all of the tasks associated with work with hazardous materials, including the use of respiratory protection, and chemical protective clothing.
- ☐ cleared to perform the tasks associated with work with hazardous materials with the following restrictions [e.g., lifting restriction (specify weight), strenuous labor restriction, respirator restriction (specify type of respirator that employee can or cannot wear), avoidance of exposure to particular chemicals (specify chemicals, etc.)]:

- ☐ not cleared to perform the tasks associated with work with hazardous materials. (please attach explanation)
- ☐ I have informed the above employee of the results of the medical examination and any medical conditions disclosed by the examination which require further examination or treatment.

Physician's Signature

(Please type or print Physician's name and address)

7.0 PROTECTIVE MEASURES

Health and safety protective measures that will be taken for the ITS Site Remediation project include actions in the following areas.

- Facilities Design
- Project Communications
- Operating Procedure Controls
- Field Personnel Safety Rules
- Health and Safety Inspections
- Personal Protective Equipment
- Confined Space Entry
- Accident and Incident Investigation

The detailed action and controls relating to each of these areas is described in the following paragraphs.

7.1 Facilities Design

The facilities provided for implementation of the Remedial Action Project are designed to permit remediation to be accomplished in a manner that will protect the health and safety of on-site workers, and the general public.

1. Facility design will comply with OSHA requirements for industrial facilities of the type required for this project.
2. All design will be performed by registered professional engineers in the discipline involved in the design.
3. Modern facilities will be provided for on-site workers (change room, restroom, lunchroom, and decontamination equipment).
4. Facilities will be designed to allow proper site access control and safe access to all on-site operational facility locations.

5. Since this is a 24-hour-per-day process, illumination levels will be maintained at or above 5 foot candles in GRC process areas.
6. Facilities will be provided so that remediation activities are implemented using the proper tools, equipment, or procedure. It is project policy to perform work using safe, well-designed facilities only, and to eliminate the use of shortcuts or inadequate tools or facilities.

7.2 Project Communications

The ITS Site Remediation project will be implemented while maintaining regular health and safety communications with all project personnel. This communications program will be implemented through the following steps.

1. Prior to beginning work on site, all personnel will be screened to assure they have received pre-training for working on a hazardous waste site, in accordance with project requirements (see Section 9.1).
2. A copy of the ITS Site Health and Safety Plan will be maintained at the site throughout the project. It will be located to be available for convenient reference for all on-site project personnel in the Health and Safety Officers office.
3. The following health and safety communications activities will be implemented with all regular project operations employees.
 - a. Before starting initial field activities, each individual will participate in a site health and safety indoctrination training program (see Section 9.2).
 - b. Weekly health and safety meetings will be held with all project employees to review experiences of the past week, discuss plans for the coming week, and discuss health and safety issues or questions that are encountered. Written minutes of these meetings will be maintained in a site Health and Safety Logbook.
 - c. Daily health and safety "Tailgate" meetings will be held with each project employee to review activities and plans for the coming day, and their health and safety precautions. Written minutes of these meetings will be maintained in the site Health and Safety Logbook.

- d. Any on-site worker may initiate a health and safety discussion on specific issues or questions he may identify. Each request will be given serious response with specific data where applicable. Any written response to these questions will be maintained in the project file.

7.3 Operating Procedure Controls

Protective measures will be taken by implementing operating procedural control activities throughout implementation of the project.

All operating procedures are documented in the ITS Site Design Reports (Volumes I and II). All project personnel will be trained in the use of these procedures. Periodic health and safety inspections will verify the procedures are maintained in use (see Section 7.5).

These procedures are designed to assure safe implementation of all regular operating duties.

7.4 Field Personnel Safety Rules

The following personnel work rules have been identified to ensure each individual can fulfill his responsibility to protect the health and safety of himself and his co-workers.

- A "buddy system" will be used at all times by all field personnel while working in the site Exclusion Zones (i.e., at least two people on site at all times). A back-up person must be in contact with site personnel (through voice, visual, or signal line) and must be suitably equipped to be able to assist site personnel in case of an emergency.
- Contamination avoidance is of the utmost importance. Whenever possible, avoid contact with contaminated (or potentially contaminated) surfaces. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or place equipment on the ground. Stay away from waste drums. Protect equipment from contact by bagging.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice which increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in site Exclusion Zones. The exception to this is drinking water and Gatorade provided for personnel in the Exclusion Zone to prevent heat stress. The drinking water cooler is to be handled with clean hands only. It will be

labeled with signs indicating that the water is "potable." Use disposable wipes before touching the cooler.

- Hands and face must be thoroughly washed upon leaving the work area and before eating, drinking, or any other activities. Good personal hygiene practices will be encouraged (especially for personnel potentially exposed to "skin absorbable" compounds such as PCBs, DMSO, etc.).
- The use of alcohol and/or illegal or controlled substances is prohibited at the ITS Site.
- Appropriate dress is required when working with potentially hazardous chemicals (see Table 7-1).
- Proper air monitoring and respiratory equipment is required for the job being performed (see Table 7-1).
- Any injury or unusual health effect must immediately be reported to the individual's supervisor and the field operations project manager.
- Use of contact lenses is prohibited while on site.
- In situations where protective equipment prevents verbal communication, hand signals must be established before starting work.
- Proper protective clothing will be worn at all times while on site (see Table 7-1).
- Hearing protection will be worn in all designated "Noise Protection" zones identified on site.
- Supervisory and individual worker attention will be applied at all times to assure proper management of potential heat stress exposure (see Section 8.3).

TABLE 7-1

RULES FOR DETERMINING
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS
ITS REMEDIATION PROJECT

- At all times when on Project Site
 - Wear safety glasses (contact lens prohibited).
 - Wear hard hat.
 - Wear safety toed shoes or boots.
 - Use the "Buddy" System.
- At all times in Exclusion Zone
 - Wear neoprene or nitrile chemical protective boots or disposable chemical boots.
- During potential body contact with contaminated soil
 - Wear Saranex[®] or Tyvek[®] coveralls
 - Wear Neoprene or Nitrile chemical protective glove(s)
- During activities with potential "wet" splashes from Process Reagents
 - Wear Saranex[®] coveralls
 - Wear Neoprene or Nitrile chemical protective gloves
 - Wear Neoprene or Nitrile chemical boots or disposal chemical boots
 - Wear face shield
- Lifting/Handling of barrels, etc.
 - Wear work gloves
- During all activities in visible dust or when performing remediation excavation and soil moving in the contaminated soil building
 - Wear full-face, air purifying respirator (combination HEPA/Organic Vapor cartridges) NIOSH-approved

TABLE 7-1 (Continued)

RULES FOR DETERMINING
PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS
ITS REMEDIAL PROJECT

- When HNu (11.7 eV) air emissions Total Organic Compounds (TOC) reading exceeds 2.0 units
 - Wear air purifying respirator with combination HEPA/organic vapor cartridge)
- When HNu (11.7 eV) air emissions Total Organic Compounds (TOC) reading exceeds 10.0 units
 - Wear self-contained breathing apparatus (SCBA) with full-faced mask.
- In pre-identified hearing protection areas
 - Use specified hearing protection.
- During APEG-Plus™ Process Upsets or Presence of Abnormal DMS Odor
 - Wear NIOSH approved full-face air purifying respirator with a combination HEPA/Organic vapor cartridge.
 - Wear Saranex coveralls
 - Wear Neoprene or Nitrile chemical protective gloves
 - Wear Neoprene or Nitrile Chemical protective boots
- During potential for, or existence of major accidental release from APEG-Plus™ process
 - Wear breathing air supplied self-contained-breathing-apparatus (SCBA)
 - Wear Saranex coveralls
 - Wear Neoprene or Nitrile chemical protective gloves
 - Wear Neoprene or Nitrile chemical protective boots

7.5 Site Health and Safety Inspections

Periodic health and safety inspections will be performed as follows:

- Daily Inspections
 - The Site Health and Safety Officer will inspect all project personal protective equipment to verify that it is clean, in good repair, and ready for use. Equipment that is not ready for use will be physically tagged with a "Do-Not-Use" tag until it can be repaired and returned to a safe condition. Used equipment that cannot be reused or repaired will be immediately discarded using the appropriate disposal method.
 - The Site Health and Safety Officer will also inspect all site offices, change room, and process facilities to assure that site housekeeping standards are continuously maintained.
- Quarterly Inspections
 - The Field Operations Project Manager will inspect all site facilities and records to assure that all health and safety procedures are in use, that site housekeeping standards are maintained, and that written records are in compliance with procedural requirements. Written minutes of this inspection and subsequent follow-up action will be maintained in the project file.

7.6 Personal Protective Equipment

Protective measures will be taken during the ITS Site Remediation Project to assure that on-site workers use the appropriate personal protective equipment during the implementation of their operating duties. The procedure for determining what protective equipment should be used involves assessing the activities to be performed. The rules describing site activities, and the respective protective equipment requirements are presented in Table 7-1.

7.7 Confined Space Entry

Entry into a vessel or confined space will be made only when no other course of action is available. The vessel contents must be completely removed prior to entry preparations. A vessel or confined space is defined as any enclosed space with only limited entryways,

or any open-top vessel or earthen pit, with a depth greater than 5.0 feet. The following procedures will be followed on each identified confined space that requires entry during the ITS project.

All confined space entries will require preparation of a written workplan procedure for the pre-testing and entry activity. This workplan will be approved in writing by the General Project Manager prior to proceeding with the entry.

7.7.1 Pre-Entry Checks

Instrument measurements of oxygen and combustible gas levels will be made with properly maintained calibrated monitors to verify the atmosphere inside the vessel contains oxygen concentration between 19.5 - 22.0%, and is not flammable (i.e., < 10% of the LEL).

Additional testing may need to be performed prior to entry to determine if toxic gases or vapors are present.

Checks will be made to determine that all pipe connections are physically broken and that any electrical or other energized connections have been disconnected and "locked out" or "tagged out."

Physical hazards related to vessel entry will be determined by observation. These include obstructions for entry and exit and obstacles inside the vessel. Potential hazards posed by deterioration must be considered in planning entry.

7.7.2 Emergency Planning and Training

Emergency Planning and Training must include preparation for use of supplied air respirators, a safety harness and lifeline, and the necessary manpower to hoist the individual out of the confined space, if necessary.

7.7.3 Actual Entry

Entry will be made using a supplied air respirator. An air line respirator can be used when it can be determined by instrument measurements that no flammable hazard, and adequate oxygen exist and concentrations of toxic gases and vapors are below IDLH concentrations. If any of these conditions are not met or cannot be positively determined, self-contained supplied air respirators (SCBAs) will be used.

Protective clothing and equipment suitable to provide adequate protection against any residues inside the vessel will be used. An observer equipped with a self-contained supplied air respirator and the same protective clothing and equipment will be stationed at the entrance to the vessel where he can observe the person inside at all times. Additional persons should be within voice contact range of the observer to provide help in the event a rescue is necessary. In no case will a rescue be attempted without the use of self-contained breathing apparatus.

7.7.4 Approvals

All workplans for entries into a confined space will be pre-approved in writing by the General Project Manager.

7.8 Accident or Incident Investigation

In the event of an accident or incident in which people, property, or equipment were or might have been injured or damaged, an investigation will be initiated as soon as the emergency conditions are under control. The form shown on Table 7-2 will be used to document the investigation and its conclusions. The Field Operations Project Manager will initiate the investigation. Upon completion of the investigation the completed report will be distributed to the General Project Manager, the Site Health and Safety Officer, the Project Health and Safety Manager, and the Injured Party's Supervisor.

The purpose of the investigation is not to attribute blame, but to determine the pertinent facts, so that repeat or similar occurrences can be avoided. The accident investigation will be used as a learning tool to help improve operations.

The investigation should begin while details are still fresh in the mind of anyone involved. The person involved in performing first aid may be able to initiate the fact gathering process if the injured person(s) are able to talk. All pertinent facts must be determined. Questions beginning with who, what, when, where, and how are usually most effective to discover ways to make performance of the job better in terms of efficiency and quality of work as well as safety and health concerns.

TABLE 7-2

ACCIDENT OR INCIDENT INVESTIGATION REPORT

Note: The purpose of the investigation is not to attribute blame or define who was at fault.
The purpose is to identify what happened so that repeat incidents can be prevented.

NAME: _____ AGE: _____ TIME: _____ DATE: _____

DEPARTMENT SHIFT: _____ JOB: _____ HOW LONG ON THIS JOB? _____

WHAT HAPPENED? _____

WHY DID IT HAPPEN? _____

WHAT SHOULD BE DONE TO PREVENT RE-OCCURRENCE _____

WHAT HAVE YOU DONE THUS FAR? _____

HOW WILL THIS IMPROVE FUTURE HEALTH AND SAFETY OF SITE OPERATIONS? _____

INVESTIGATED BY: _____ DATE: _____

REVIEWED BY SITE SUPERINTENDENT _____ DATE: _____

- cc:
- General Project Manager
 - GRC Project Manager

7.9 Noise Protection

Based on an initial Noise Survey performed during initial startup of equipment, or when noise sources are brought on site, noise protection zones will be established to assure on-site personnel are not exposed to excess noise levels. This Noise Protection Program will comply with the requirements of OSHA Noise Standard (29 CFR 1910.95).

Based on actual survey results, any areas exceeding 85 dbA will be clearly identified as a Noise Protection Zone, and hearing protection will be worn by anyone entering that zone. The zones will be identified with signs (and tape if the noise source is stationary) stating that noise protection is required in that zone.

8.0 EMERGENCY PROCEDURES

Several potential emergency situations may be encountered during the ITS Site Remediation Project. These are listed below with the appropriate response procedures that will be followed.

A complete Spill/Emissions Release Contingency Plan for the ITS Site Remediation project has been prepared and approved by EPA. A copy of this document is available at the project site.

8.1 Medical Emergencies

The occurrence of a medical emergency or accident will be communicated to the Site Health and Safety Officer, the Field Operations Project Manager, and the GRC Project Manager, immediately. Medical assistance will be administered as follows:

- Minor accidents requiring simple first aid procedures will be treated at the site by the individual's supervisor.
- The Field Operations Project Manager and Health and Safety Officer will be trained and certified in the use of first aid and CPR methods.
- Accidents requiring a doctor's care, but not requiring hospitalization or emergency room care, will be treated at the Kelsey-Seybold Clinic located in the St. Luke's Towers in the Medical Center. The address is 6624 Fannin. The phone number is 791-8700.
- Accidents requiring emergency room care and/or hospitalization will be transported to a hospital. Available ambulance service and hospitals are:

Ambulance Services

Houston Emergency Ambulance Service
Phone: 911

Hospital Services

Methodist Hospital
6565 Fannin
Houston, Texas
Phone: 790-2245

Herman Hospital
6411 Fannin
Houston, Texas
Phone: 797-4060

The location of these facilities is shown on Figure 8-1.

8.2 First Aid Procedures

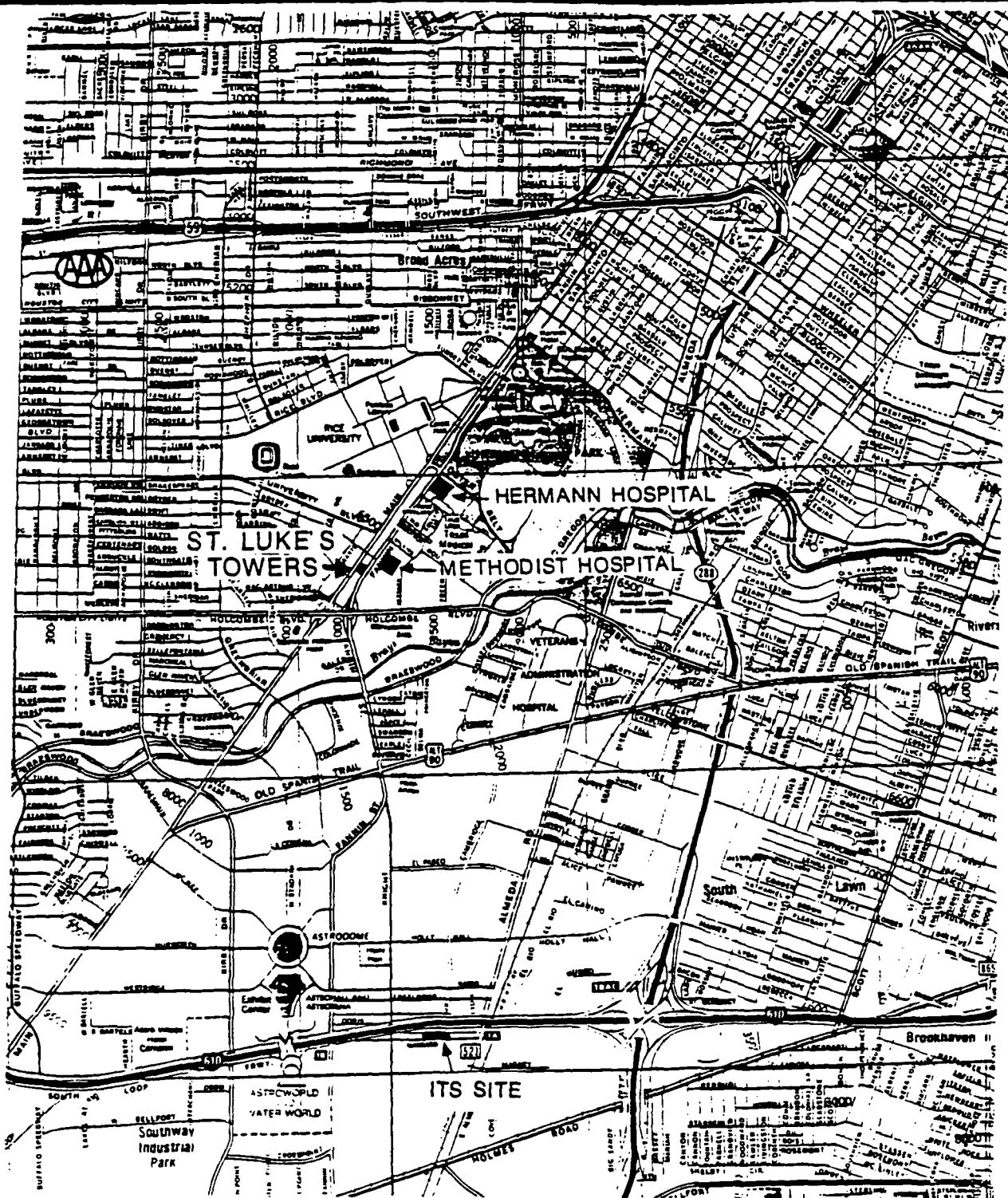
The Field Operations Project Manager and the GRC Project Manager will maintain first aid and burn kits on site for treatment of minor injuries. Eye-wash fountain and safety shower facilities are provided in the APEG-PLUS™ Process Area. They or their designees will be responsible for deciding when additional medical attention is required.

Upon the decision that additional medical attention is required, an uninjured project person will accompany the injured party to one of the above listed hospitals, doctor's office, or clinic. The project person will stay with the injured party until treatment is completed, at which time he will accompany the individual back to the job site. Should hospitalization be required, the project person will get the injured settled in the hospital before returning to the project site.

8.3 Heat Stress

In any task requiring impermeable coveralls, heat stress (heat stroke or heat exhaustion) is always a concern.

This section of the Health and Safety Plan presents the preventive practices to be followed when a threat of over-exposure to heat exists on the project. Preventive measures will be instituted first to prevent heat stress. If the preventive measures are not effective, worker monitoring and control measures shall be implemented.



0 1/2
SCALE IN MILES

REFERENCE: AAA Houston Street Map, 1989.

ENSRTM

ENSR CONSULTING AND ENGINEERING

FIGURE 8-1
MEDICAL FACILITIES
INDUSTRIAL TRANSFORMER SUPERFUND SITE
HOUSTON, TEXAS

DRAWN BY: SJF	DATE: 3-13-91	PROJECT NUMBER:
CHK'D BY:	REVISED:	3260-013-350

Definitions

The following terms have specialized definitions when used with respect to the heat stress program:

Air Temperature is the temperature measured with a standard mercury-in-glass thermometer with the bulb shielded from the sun and other radiant heat sources.

Heart Rate Monitor is an electronic instrument which measures the pulse as an indicator of heart rate. The Pulse Meter manufactured by Labtron is recommended; or the use of a watch to time an interval while counting the pulses using the finger.

Heat Disorder is a general term used to describe the illnesses associated with heat exposure.

Heat Stress is the combination of environmental and physical work factors that constitute the total heat load imposed on the body. Environmental factors such as humidity and air temperature, can affect the body's heat transfer capability. If the worker must perform strenuous work under unfavorable ambient conditions, heat stress conditions exist.

Heat Rash can be caused by continuous exposure to hot and humid air. The condition is characterized by a localized red skin rash and reduced sweating. Aside from being a nuisance, the ability to tolerate heat is reduced.

Heat Exhaustion is a mild form of shock caused by sustained physical activity in heat. Profuse perspiration without adequate fluid and salt replacement also contributes. The signs and symptoms of heat exhaustion include a weak pulse, shallow breathing, pale/cool/moist/clammy skin, profuse sweating, dizziness and fatigue.

Heat Stroke is the most severe form of heat stress. Immediate cooling is necessary to prevent injury or death. The signs of heat stroke include red/hot/dry skin, body temperature of 105°F or higher, no perspiration, nausea, dizziness and confusion, rapid pulse and loss of consciousness.

Impermeable Work Clothing includes semi-permeable or impermeable encapsulating ensembles such as disposable Tyvek and Saranex coveralls, nitrile gloves, etc.

Normal Work Clothing is the permeable clothing made of cotton or synthetic cloth.

For the following reasons, the ITS Site Remediation Project will experience the potential for requiring heat stress prevention measures.

- Relative Humidity
- Type of Work Required - The metabolic heat generated during heavy, moderate or light work.
- Required Work Clothing - The potential for heat stress increases as the impermeability of the work clothing increases.
- Employee conditioning/acclimatization.
- Experience on similar projects.

This Health and Safety Plan includes a two phase approach to combating the problem of heat stress. The first phase is a series of preventive measures which allow the worker to continue their normal tasks without disruption. Where the first phase preventive measures are inadequate in terms of worker exposure to excessive heat, the second phase monitoring and control measures will be implemented. Worker monitoring will reduce heat stress related injuries by adjusting the work/rest times.

Heat Stress Prevention

The first phase in implementing heat stress prevention measures is to take a number of preventive measures which do not interfere with the employee's job task to any significant degree. Training is an important first step in the process. The importance of the following factors should be reviewed with the employees in the daily site safety "tailgate" meeting:

- Heat stress symptoms (see the definitions on page 8-4).
- First aid measures.
- Methods which may be used to prevent heat stress.
- Importance of maintaining body fluids at normal levels.

- Adverse impact of caffeinated or alcoholic beverages on accelerating the rate of body water loss.
- Importance of maintaining physical fitness.
- Self-monitoring procedures (i.e., temperature and pulse).
- Benefits and factors of acclimatization.
- Components of the Health and Safety Plan concerning heat stress.
- Importance of avoiding alcohol consumption while project is in progress.

The second step is to select the best combination of preventive measures which suit the circumstances of the project including:

Acclimation of the workers so they become better able to deal with the rigors of working in hot environments. The degree to which a worker's body has physiologically adjusted or acclimatized to working under hot conditions affects his or her ability to do work. Acclimatized individuals generally have lower heart rates and body temperatures than unacclimatized individuals and sweat sooner and more profusely. This enables them to maintain lower skin and body temperatures at a given level of environmental heat and work loads than unacclimatized workers.

Acclimation can occur after just a few days of exposure to a hot environment. A progressive 6-day acclimation period may be necessary for the unacclimated worker before allowing him/her to do full work on a hot job. Under this regimen, the first day of work on site is begun using only 50% of the anticipated workload and exposure time and 10% is added each day through Day 6. With fit or trained individuals, the acclimatization period may be shortened 2 or 3 days. However, workers can lose acclimatization in a matter of a few days and work regimens should be adjusted to account for this.

Reduction of manual labor by mechanization of tasks is another factor to be considered in the Health and Safety Plan. Use of a backhoe instead of shoveling, and the use of a crane to lift or move drums, are examples of how mechanization can be used to reduce heat stress.

Modification of the thermal environment is also possible to a limited degree. Control of radiant heat gain is best accomplished by shielding. For example, umbrellas are available which can be used to shade equipment operators from the sun. Reducing heat gain from convection may be accomplished by supplying cooler air to the work environment.

Temperature reduction in rest area is also a good preventive measure. As a minimum, break areas, locker rooms, and lunchrooms should be located in shaded areas. Ideally, the rest area should be maintained at a temperature of approximately 77°F.

Clothing modifications can reduce the amount of time an employee is in full protective clothing. While an adequate level of personal protective clothing is always required on a project, the impact of this clothing on the employee's heat balance should always be remembered. Do not impose a higher level of protective on the employee than necessary, particularly if it will compromise his/her ability to deal with heat stress.

Fluid replacement must always be provided. Adequate supplies of drinking water and drinks are always available to employees so that fluid lost by sweating is replaced. Workers should be encouraged to drink more fluids when working in hot environments. Increased dietary salt or lightly salted (0.2 percent) water is adequate to replace lost salt. Salt tablets are not to be used. If juice or electrolyte drinks are used, they should be diluted prior to drinking. Thirst is not an adequate indicator of body water loss. Workers are to drink at least small amounts of water on each break.

When enclosed in an impermeable suit, physically-fit, acclimatized individuals sweat more profusely than unfit or unacclimatized individuals and may therefore actually face a greater danger of heat exhaustion due to rapid dehydration. This can be prevented by consuming adequate quantities of water.

Reduced time for employees working in the hottest environment is another measure. Work/rest periods should be developed according to the results of the worker monitoring program. Scheduling heavy workloads for a cooler part of the day is another successful method.

Monitoring Procedures

If the preventive measures outlined above are not effective in reducing heat stress in terms of the observed symptoms, then the second phase of the program will be implemented. These procedures are outlined in this section.

Weight loss monitoring is used as a direct measurement of the impact the hot environment is having on the worker fluid balance. The workers weight is measured at the beginning of the day on a scale accurate to ± 0.25 pound. The worker is then measured at the end of the day and other appropriate times throughout the day to determine if adequate fluids are being taken in to prevent dehydration. Weights should be taken while the worker wears similar or no clothing. The body water loss should not exceed 1.5% of the total body weight loss in a work day according to the following equation:

$$[\text{Start Weight} - \text{End weight}] \div \text{Start Weight} > 0.015$$

Heart rate monitoring is also useful in determining the exposure of the employee to excessive heat.

The pulse rate is measured in the wrist as early as possible after the period of stress according to the frequency specified in the following table.

Working in Shade Dry Bulb Thermometer Temperature	Working in Sunlight Bulb Thermometer (Shielded From Sun) Temperature	Frequency of Pulse Monitoring	
		Impermeable Clothing	Normal Work Clothes
Greater than 90°F	Greater than 77°F	After each 15 minutes of work	After each 45 minutes of work
87.5°F - 90°F	74.5°F - 77°F	After each 30 minutes of work	After each 60 minutes of work
82.5°F - 87.5°F	69.5°F - 74.5°F	After each 60 minutes of work	After each 90 minutes of work
77.5°F - 82.5°F	64.5°F - 69.5°F	After each 90 minutes of work	After each 120 minutes of work
72.5°F - 77.5°F	60°F - 64.5°F	After each 120 minutes or work	After each 150 minutes of work

Oral temperature monitoring should also be used any time the heart rate exceeds 110 beats per minute. A clinical thermometer available from a drug store (3 minutes under the tongue) or similar device (IVAC digital thermometer) to measure the oral temperature at the end of the work period. Oral temperatures should be taken before drinking cool fluids.

Worker monitoring shall be conducted until a work/rest cycle is established which controls work weight loss, heart rate, oral temperatures to an acceptable level.

Control Measures

If the heart rate exceeds 110 beats per minute, shorten the next work cycle one-third and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

If the oral temperature exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. If the oral temperature still exceeds 99.6°F at the beginning of the next rest period, shorten the following work cycle by one-third.

Semi-permeable or impermeable garments will not be worn when the workers oral temperature exceeds 100.6°F.

Recordkeeping

The monitoring results shall be recorded on the Heat Stress Monitoring log found on page 8-11. The records maintained in the project file for the active life of the project. At the end of the project, these files are transferred to the medical records maintained by the Director of Health Safety and Compliance.

Response

The procedures presented herein are to be followed during an incident where a worker is adversely affected by an overexposure to heat. Whenever a worker is significantly affected by heat stress and requires treatment as indicated below, the reporting provisions of the incident Reporting Procedures must be followed. All workers are to remain alert to the symptoms of over-exposure to heat in themselves and their fellow workers. Treatment for over-exposure is recommended below.

- *Heat rash* treatment includes keeping the skin hygienically clean and allow it to dry thoroughly after using chemical protective clothing.
- *Heat cramps* treatment includes removing the affected person to a cool place. Salted water or other electrolyte source such as Gatorade ingested slowly should help mitigate the cramps. Manual pressure may also be applied to the cramped muscles.
- *Heat exhaustion* treatment includes removal of the affected person to the cool shade, removal of as much clothing as possible, sips of salted water or gatorade, and fanning the person continually to remove heat by convection. Do not allow the affected person to become chilled. Treat for shock if necessary.
- *Heat stroke* treatment includes placing the individual in the shade, removing as much clothing as possible, pouring cool water on the person and fanning him vigorously. Summon emergency medical assistance since the transportation of the victim to a medical facility must not be delayed. Apply cold packs, if available; place under the arms, around the neck, or any other place where they can cool large surface blood vessels. If convulsions develop, prevent victim from biting his tongue. If transportation to a medical facility is delayed, reduce body temperature by immersing victim in an ice/water bath (however, be careful not to over chill the victim once body temperature is reduced below 102° F). If this is not possible, keep victim wrapped in a sheet and continuously douse with water and fan.

8.4 Fires

Fire extinguishers will be available at appropriate locations for control of small fires, should they occur. As with medical emergencies, all fires must be reported immediately to the Site Safety and Health Officer, the Field Operations Project Manager, and the GRC Project Manager. Major fires will require that the nearest fire department be summoned using telephone number 911.

**TABLE 8-1
HEAT STRESS MONITORING LOG**

Project Name: _____		Date: _____					
Site Safety Supervisor: _____		Site Supervisor: _____					
Employee Name							
Start Weight							
Start time							
<u>Measurement 1</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 2</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 3</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 4</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 5</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 6</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 7</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							
<u>Measurement 8</u>							
Oral Temp							
Pulse							
Work Minutes							
Rest Minutes							

9.0 HEALTH AND SAFETY TRAINING

In accordance with the Industrial Transformer Superfund (ITS) Site Consent Decree, all activities on site will be conducted in compliance with the requirements of Occupational Safety and Health Guidance for Hazardous Waste Site Activities (29 CFR 1910.120).

Based on the OSHA requirements, each individual working on the ITS Site project will receive the following training.

9.1 Initial Off-Site Training

Prior to beginning work in the ITS Site Exclusion Zone, each employee, contractor, and subcontractor will receive 40 hours training in accordance with 29 CFR 1910.120(e)(3)(i). If the individual's activities are limited to work outside the Exclusion Zones of the site, he will receive a minimum of 24 hours training in accordance with 29 CFR 1910.120(e)(3)(iii).

Workers on site only occasionally for a specific limited task (such as, but not limited to surveying, or geophysical surveying) and who are unlikely to be exposed over permissible exposure limits shall also receive at least 24 hours training in accordance with 29 CFR 1910.120(e)(e)(ii).

Before beginning on-site work as a manager or supervisor for the ITS Site project (employee, contractor, or subcontractor), the individual will receive the 40-hour training described above and, additionally, will complete 8 hours management/supervisory training in accordance with 29 CFR 1910.120(e)(4).

9.2 Initial On-Site Training

On the first day at the site, and prior to beginning field work, each employee, contractor, and subcontractor will receive ITS Site Health and Safety Indoctrination Training. The Site Health and Safety Officer will review the following subjects during this initial indoctrination.

- Review the project organizational structure and its chain of command.
- Review the contents of the following plans for the ITS Site project.
 - Design Reports (Volume I and II),
 - Health and Safety Plan,

-
- Spill/Emission Contingency Plan.
 - Review of current site operations and potential hazards, including the identification of work zones.
 - Review the site chemical hazards described in the Health and Safety Plan and MSDS information.
 - Review the protective equipment used at the site, when it should be used, and how to use it properly.
 - Review the nature of heat exhaustion, its symptoms, and its prevention.
 - Perform a respirator fit test, and verify the individual understands how to use a cartridge type respirator, and an SCBA, and the site rules describing when it is required.
 - Review where the ITS Site project plans are located and encourage the individual to ask questions or refer to the plans for Health and Safety information.
 - *Review the policy requiring each individual to work under close supervision of an experienced site supervisor for his first 3 days of field work and identify the individual responsible for this action.*
 - Review the site housekeeping program and the employees responsible to maintain a neat, clean site, and dispose of waste material in proper waste containers.
 - Review the site's safety program requirement that everyone promptly report injuries to the Health and Safety Officer.
 - Review the site's safety program requirement that each individual at the site accept responsibility to understand all Health and Safety procedures and to actively be responsible for his personal health and safety, as well as his co-workers.
 - Review proper drum handling procedures, and heavy equipment that may be encountered at the site.

- Emphasize decontamination procedures required upon leaving the site Exclusion Zone.

Upon completion of the indoctrination training, each employee, contractor, or subcontractor will sign the Training Verification Record shown in Table 9-1, to provide a permanent record of his training course.

9.3 Retraining

After initial training described in Section 9.1, each individual employee, contractor, or subcontractor will be required to complete 8 hours refresher training in accordance with OSHA 29 CFR 1910.120(e)(8) each year. This refresher training will be required, whether the individual has worked full time at the ITS Site or not.

9.4 Emergency Response Training

The Field Operations Project Manager, the Health and Safety Officer, and the Galson Remediation Company supervisory personnel shall receive the following special emergency response training.

- Detail review of the ITS Site - Health and Safety Plan, Section 8.0.
- Detail review of the ITS Site - Spill/Emission Contingency Plan.
- Detail instructions on the responsibilities for each individual, in each emergency response situation that is anticipated.

9.5 Training Certification Records

The Field Operations Project Manager will maintain a copy of each individual's training and retraining certificate verifying his receipt of the 40-hour, 24-hour, or 8-hour initial training, and his 8-hour annual retraining. Entries in the Health and Safety Logbook will record the days that special supervision is provided to each new on-site worker.

The Field Operations Project Manager is responsible for maintaining a record of when each worker requires retraining, and if necessary, notifying the workers' supervisor in sufficient time to schedule and receive the retraining.

TABLE 9-1

INDUSTRIAL TRANSFORMER SITE
HEALTH AND SAFETY TRAINING
VERIFICATION RECORD

To: ITS Project, Field Operations Project Manager

This is to verify that I have received the ITS Project Health and Safety Indoctrination Training. I have read the **ITS Site - Health and Safety Plan** and understand its contents.

I agree I will abide by the ITS Project Health and Safety requirements. I understand that I am responsible for my own health and safety as well as that of my co-worker, and I will support project supervision's efforts to achieve safe and healthy project implementation.

Name (please print)

Signature

Company

No individual will be allowed to perform work at the site without training and retraining certification appropriate to his job assignment.

9.6 Site Visitors

A site visitor is defined as an individual requiring access to the site for less than one (1) day who is not directly involved in site operations or maintenance.

All visitors to the site will be retained at the East Entry Gate until site entry is approved by the *Field Operations Project Manager* or his designated alternate. They will be issued a safety hat, safety glasses, and disposable rubber boots upon entry approval and requested to wear these items at all times while on site.

Visitors will not be required to have the 40-hour, 24-hour, or 8-hour training for entry to the site.

Visitors will be accompanied by trained and experienced site personnel at all times, while on site. The site personnel will be responsible for ensuring the individual follows all site procedures and rules during his visit.

10.0 SITE CONTROL

Work zones are established at the ITS Site to minimize the potential for spread of contamination and to assist in delineating personnel protective requirements. Zones are established as defined below. The zones are shown on Figure 10-1 and Figure 10-2.

10.1 Exclusion Zone

The exclusion zone is the area in which contamination exists or could exist. The "Hotline" is the outer boundary of the exclusion zone. It is established to mark the outer limits of any contamination and to isolate the area in which work is to be performed. The Hotline is clearly marked by hazard tape and signs or enclosed by a physical barrier.

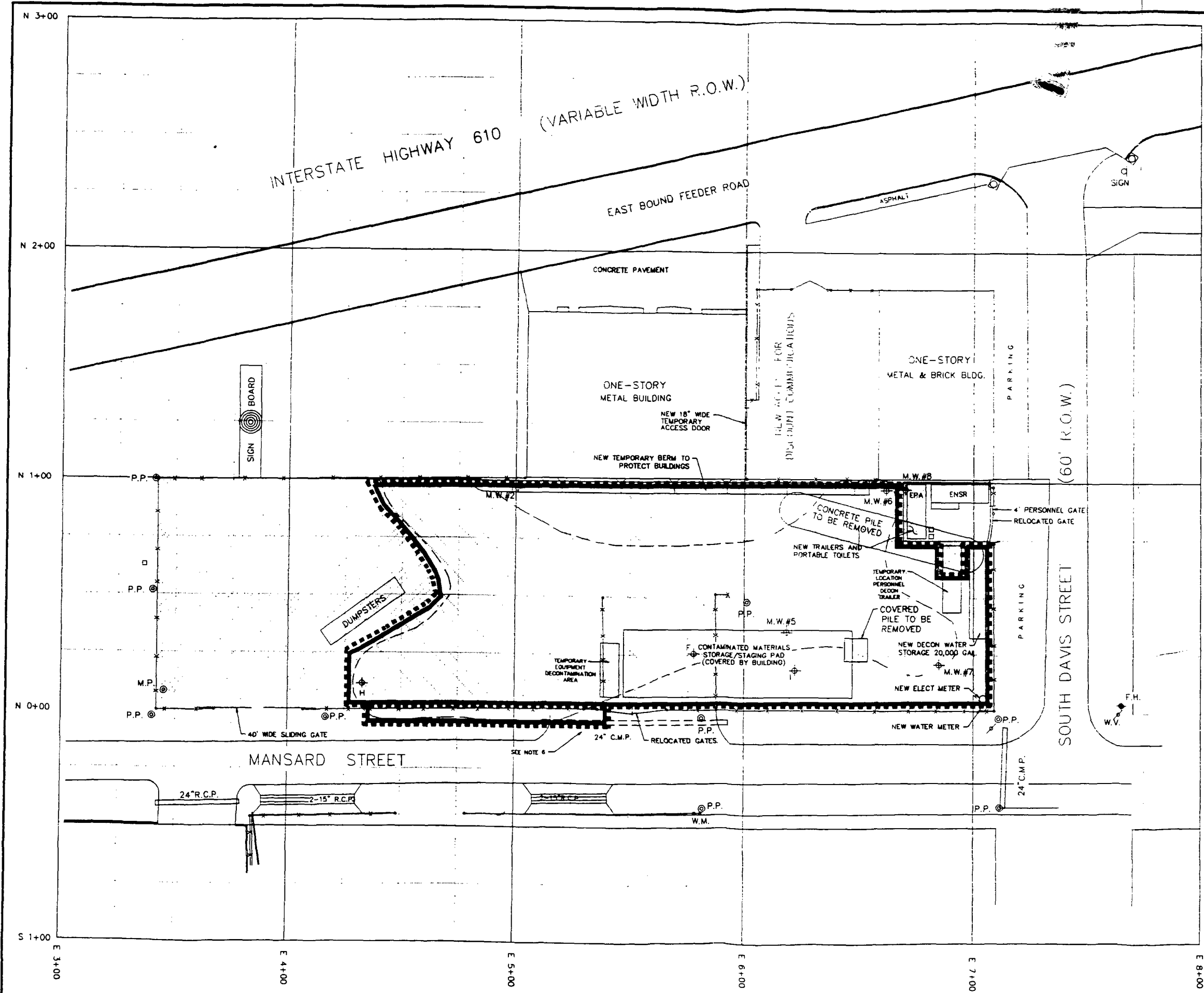
10.2 Decontamination Zone

The decontamination zone is the transition area between the contaminated area and the clean area. This zone serves to further assure that contamination is not spread to clean areas. Workers and equipment are decontaminated within designated areas of the decontamination zone. The outer boundary of the decontamination zone is clearly marked. It is called the contamination control line. Access control points are identified to control the flow of people and equipment into and out of the decontamination zone and exclusion zone.

Hand and face washing facility, toilet facilities, showers, benches or seating, shade, and drinking water or liquids are located in a designated rest area in the decontamination zone. Decontamination procedures for the ITS Site project are described in Section 12.0 of this Health and Safety Plan.

10.3 Support Zone

The support zone is the area outside the decontamination zone in which administrative and other support functions necessary to keep operations in the exclusion and decontamination zones running smoothly are located. This zone is maintained free of contamination and normal work clothing is permitted.



- NOTE:
1. REMOVE EXISTING CONCRETE & WOODMAT DRIVEWAY.
 2. REMOVE AND REVISE EXISTING FENCES INSIDE OF THE EXCLUSION AREA.
 3. FIELD TO ERECT TEMPORARY DECON AREA USING HEAVY DUTY LINER & ROAD SURFACING, AND TRAILER FACILITIES TO SERVE VEHICLES AND PERSONNEL. CONNECT WITH HOSE TO WATER AND WASTE STORAGE.
 4. FIELD TO COVER ACTIVE EXCAVATION TO PREVENT RUNOFF OF POTENTIALLY CONTAMINATED WATER.
 5. AFTER REMEDIATION VERIFICATION SITE TO BE GRADED AS SHOWN ON DRAWING C1 & C2.
 6. FIELD TO INSTALL TEMPORARY FENCE AND PROVIDE ACCESS DURING REMEDIATION OF AREA SOUTH OF PERMANENT FENCE.
 7. EXISTING MONITOR WELLS THAT OBSTRUCT OPERATIONS TO BE CAPPED WITH MANHOLE AS DESCRIBED IN REPORT.
 8. REMOVE EXISTING FENCES INSIDE EXCLUSION ZONE REUSING MATERIAL AS POSSIBLE SITE SECURITY TO BE MAINTAINED DURING FENCE RELOCATION.

- WORK ZONES:
- ☐ SUPPORT
 - ☐ CONTAMINATION REDUCTION
 - ☐ EXCLUSION
 - ☐ HOT LINE
 - ☐ CONTAMINATION CONTROL LINE
 - ☐ WASTE MANAGEMENT AREA

DESIGN	J. GREENE	DATE	2-19-91	DRIVING NUMBER	G-2
DRAWN	NLI/JME	SCALE	1" = 20'	PROJECT NO.	9504-002
CHECKED	A. LILLIE	APPROVED	H. CLARK	SHEET NO.	7 OF 12

ISSUED FOR DESIGN REPORT

REVISIONS

BY

DATE

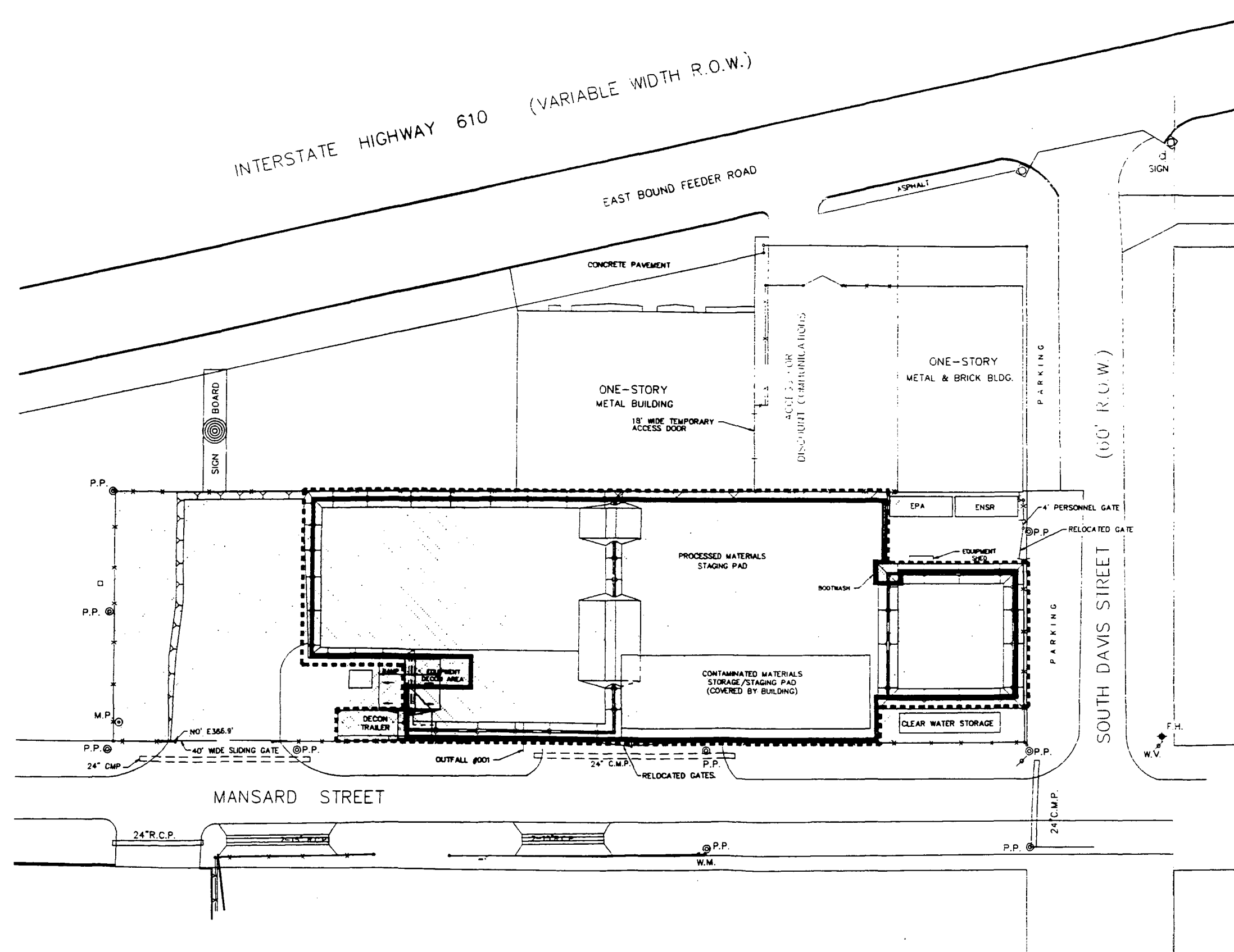
APPROVED BY

CLIENT

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ENSR
ENSR ENVIRONMENTAL SYSTEMS DIVISION

FIGURE 10-1
PRETREATMENT SITE ARRANGEMENT
ITS SITE - HOUSTON, TEXAS



- WORK ZONES:
- SUPPORT
 - CONTAMINATION REDUCTION
 - EXCLUSION
 - HOT LINE
 - CONTAMINATION CONTROL LINE

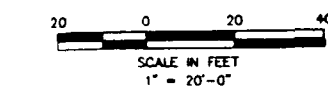


FIGURE 10-2

R	3/8/91	ISSUED FOR DESIGN REPORT	J.G.	A.L.	
NO.	DATE	REVISIONS	BY	DATE	CLIENT APPV
APPROVED BY _____ DATE _____					
CLIENT					
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ENSR ENSR ENVIRONMENTAL SYSTEMS DIVISION					
WORK ZONES - SOIL DECHLORINATION TREATMENT PHASE ITS SITE - HOUSTON, TEXAS					
DESIGN	J. GREENE	DATE	2-20-91	Drawing Number G-3	
DRAWING	M.J./J.M.E.	SCALE	1" = 20'		
CHECKED	A. LILLIE	APPROVED	H. CLARK	PROJECT NO.	9504-002
				SHEET NO.	8 OF 12

Security measures which will be in place during remediation will reduce the potential for unlawful entry and vandalism which could result in spills or releases and unauthorized or accidental entry that would result in unnecessary exposures.

The entire site is secured with 6-foot-high chainlink fencing and locked gates. Warning signs are located on the fencing to deter unauthorized entry to the site. Personnel will be staffed on site 24 hours/day while dechlorination treatment is in progress. If shutdown occurs, or only one shift of operation per day is scheduled, the gates will be locked during the time the site is unoccupied and a security guard will be present. At other times including pre- and post-mobilization of GRC equipment, the site will be patrolled by a private security service as requested by the Field Operations Project Manager.

A sign-in, sign-out log will be maintained at the site superintendent's office, and everyone entering or leaving the site will be required to sign in and out.

Since GRC will operate 24 hours per day, 7 days per week, GRC's process equipment will be under constant surveillance by facility (GRC) personnel. Video security and monitoring systems, located in the control room trailer, will be operated 24 hours a day. This system, equipped with four screens, will allow personnel to survey ports of entry, important equipment and areas where safety must be monitored. In addition, GRC personnel will routinely inspect the entire mobile treatment unit area, maintaining contact through the use of 2-way radios.

11.0 EXPOSURE MONITORING

During the ITS Site Remediation project activities, periodic monitoring of on-site workers will be performed to verify that protective measures to prevent inhalation exposure, are effective. These monitoring results will be compared to OSHA health criteria. Should the results exceed those criteria, modifications will be made immediately to protective measures (described in Section 7.0) as necessary to assure on-site worker exposure is controlled to safe levels over the duration of the project.

Nuisance Dust personnel monitoring will be performed as described in Table 11-1.

PCB personal monitoring will be performed as described in Table 11-2.

Fenceline ambient air monitoring is also performed during the ITS remediation activities. The ambient air monitoring program is described in the ITS Site Design Report - Volume I - Section 13.1.13.

The results of on-site worker monitoring will be recorded in the site health and safety officer logbook and will be communicated to all on-site workers.

The determination of nuisance dust concentrations will be performed in accordance with NIOSH Method 0500 (see appendix B) as follows:

- Sample Location: - Pre-treatment remediation excavation worker.
- Contaminated soil building soil handling worker.
- Sample Frequency: - One worker in each job, weekly for 3 consecutive weeks. Then change to one worker monthly in each job.
- Sampling Method: - Personal monitoring pump operating at 2 liter per minute flow rate, with a pre-weighed PVC filter contained in a 37-mm plastic cassette, located in individual's breathing zone. Sample for 8-hour work day with precise time of starting and stopping the sampling pump recorded on the sample chain of custody. The sample pump will be pre and post calibrated in accordance with OSHA instruction CPL 2-2.20A (see Appendix B).
- Analysis Method: - Determine nuisance dust concentration (in mg/cubic meter) via precision laboratory weigh scales by weighing the filter before and after sampling. This analysis will be performed by an AIHA accredited laboratory.
- OSHA Criteria: - Permissible exposure limit for total nuisance dust is 15.0 mg/cubic meter.

PCB PERSONAL MONITORING

- **Sample Location:** - Pre-treatment remediation excavation worker
- Contaminated Soil Building Soil Transfer Worker
- APEG-PLUS™ Process Operations worker
- **Sample Frequency:** - One worker in each job sampled weekly for first 3 weeks, then change to one worker monthly in each job.
- **Sampling Method:** - Personal monitoring pump operating at 2 liters per minute flow rate, with fiber glass filter contained in a 37 mm plastic cassette, followed by a florsil sorbent tube. Sample from individual's breathing zone for 8-hour work day with precise time of starting and stopping the pump recorded on the sample chain of custody. The sample pump will be pre and post calibrated in accordance with OSHA instruction CPL 2-2.20A (see Appendix B).
- **Analysis Method:** - Determine total PCB in filter dust and on florsil sorbent by NIOSH Analysis Method 5503, performed in an AIHA-accredited laboratory.
- **OSHA Criteria:** - Permissible exposure limit for total PCB is 0.5 mg per cubic meter for Aroclor 1254, or 1.0 mg per cubic meter for Aroclor 1242.

12.0 DECONTAMINATION

In general, everything that enters the Exclusion Zone at the ITS Site must be either decontaminated or properly discarded upon exit from the zone. All decontamination will be performed in the facilities provided specifically for this purpose (see Drawing G-2 in the ITS Site Design Report - Volume I - Appendix H). Decontamination will be accomplished in the following manner:

12.1 Personnel Decontamination

- Scrub boots and outer gloves with detergent solution.
- Rinse boots and outer gloves with water.
- Remove boots and outer gloves and deposit disposable items in the hazardous disposal container provided.
- Remove Saranex or Tyvek® coveralls and deposit in hazardous disposal containers provided.
- Remove inner gloves and deposit in hazardous disposal container provided.
- Wash face and hands with soap and water.
- Wash respirators with soap and water, or sanitizer.

For complete detail of decontamination procedure for all levels of protective equipment, see Appendix C.

12.2 Equipment Decontamination

- High pressure water wash.
- Rinse with water.
- If necessary, wash with detergent solution, see Section I - Decontamination and Demobilization Plan of Volume II for wipe sample procedure.

- Heavy equipment (backhoe, barge, crane, etc.) may require scrubbing heavily-soiled areas with kerosene or diesel fuel, followed by high-pressure water (or steam) cleaning.
- All decontamination wash fluids will be collected and processed through the ITS Site water treatment plant prior to discharge.
- All washed equipment will be wipe sampled for PCB concentration in accordance with the wipe sample method described in Appendix H of the Design Report, Volume II.

13.0 HAZARD COMMUNICATION

This program is designed to ensure that everyone involved in any site activities is aware of the hazardous properties of substances with which they may come in contact during the performance of their job and the appropriate protective measures to prevent adverse effects. This program provides compliance with the OSHA 29 CFR 1910.1200(i) Hazard Communication Requirements.

It is each individual's responsibility to ensure that the hazards of all chemicals acquired, used, and/or encountered at the site are recognized, understood, and controlled. Information regarding hazard, proper handling, and precautions is made readily available through material safety data sheets (MSDS), contained in Appendix A.

An MSDS will be available for PCBs and TCE, as well as each chemical product brought on site. Chemical products will not be accepted for delivery unless an MSDS has been provided. The MSDS must be reviewed by the Site Health and Safety Manager and entered into the MSDS binder before use of the material is initiated.

An MSDS for each product on site will be maintained in the ITS Site - Health and Safety Plan kept in the Site Health and Safety Officer's office. This file will serve as the inventory of products in use.

Each MSDS for a new product or revisions to existing MSDSs will be reviewed with all site workers prior to allowing the product to be used. The MSDS review will describe the intended use and site operating conditions in addition to the MSDS information.

Any on-site worker requesting to see the MSDS for a chemical to which he might be exposed will be provided access to the MSDS in the loose-leaf binder file.

The Field Operations Project Manager is responsible for maintaining the loose-leaf binder on a current basis. When a product is no longer being used, the MSDS will be transferred to an inactive file.

Labels applied by the manufacturer to containers of incoming product will be kept intact and used as a reference. Transfer of products to a secondary container will require appropriate re-labeling of the secondary container.

APPENDIX A

MATERIAL SAFETY DATA SHEETS

MSDS INDEX

ACETONE
COMPRESSED AIR
COPPER
DIESEL FUEL
DOWANOL® TMH GLYCOL ETHER
DIMETHYL SULFOXIDE (DMSO)
ETHYLENE GLYCOL
#2 FUEL OIL
HELIUM
HEXANES
HYDROCHLORIC ACID (1N)
HYDROGEN
ISOPROPYL ALCOHOL
KEROSENE
METHANOL
METHYLENE CHLORIDE
NITROGEN
PARATHERM NF
POLYCHLORINATED BIPHENYLS (PCB)
POLYGLYCOL E-400
POTASSIUM HYDROXIDE (KOH)
SODIUM HYDROCHLORITE (5% SOLUTION)
SULFURIC ACID (95-98%)
TRICHLOROETHYLENE (TCE)

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

A0446 -02

Effective: 08/27/86

Acetone

Page: 1

Issued: 09/04/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Acetone
Formula: $(CH_3)_2CO$
Formula Wt: 58.08
CAS No.: 67-64-1
NIOSH/RTECS No.: AL3150000
Common Synonyms: Dimethyl Ketone; Methyl Ketone; 2-Propanone
Product Codes: 9010,9006,9002,9254,9009,9001,9004,5356,A134,9007,9005,9008

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
1	3	2	1
SLIGHT	SEVERE	MODERATE	SLIGHT

Laboratory Protective Equipment



Precautionary Label Statements

DANGER!

CAUSES IRRITATION

EXTREMELY FLAMMABLE

HARMFUL IF SWALLOWED OR INHALED

Keep away from heat, sparks, flame. Avoid contact with eyes, skin, clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. Flush spill area with water spray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Acetone	90-100	67-64-1

SECTION III - PHYSICAL DATA

Boiling Point: 56°C (133°F) Vapor Pressure(mmHg): 181

Continued on Page: 2



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SECTION III - PHYSICAL DATA (Continued)

Melting Point: -95°C (-139°F)

Vapor Density(air=1): 2.0

Specific Gravity: 0.79
(H₂O=1)

Evaporation Rate: ~10
(Butyl Acetate=1)

Solubility(H₂O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless liquid with a fragrant sweet odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup): -18°C (0°F)

NEPA 704M Rating: 1-3-0

Flammable Limits: Upper - 13.0 % Lower - 2.6 %

Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.
(Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 1780 mg/m³ (750 ppm)

Short-Term Exposure Limit (STEL): 2375 mg/m³ (1000 ppm)

Permissible Exposure Limit (PEL): 2400 mg/m³ (1000 ppm)

Toxicity: LD₅₀ (oral-rat)(mg/kg) - 9750
LD₅₀ (oral-mouse)(mg/kg) - 3000
LD₅₀ (ipr-mouse)(mg/kg) - 1297
LD₅₀ (skn-rabbit) (g/kg) - 20

Continued on Page: 3

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MATERIAL SAFETY DATA SHEET

A0446 -02

Acetone

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SECTION V - HEALTH HAZARD DATA (Continued)

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Vapors may be irritating to skin, eyes, nose and throat.
Inhalation of vapors may cause nausea, vomiting, headache, or loss of consciousness.
Liquid may cause permanent eye damage.
Contact with skin has a defatting effect, causing drying and irritation.
Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation.
Chronic effects of overexposure may include kidney and/or liver damage.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, if conscious, immediately induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, sources of ignition

Incompatibles: halogen acids and halogen compounds, strong bases, strong oxidizing agents, caustics, amines and ammonia, chlorine and chlorine compounds, strong acids, esp. sulfuric, nitric, hydrochloric

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Shut off ignition sources; no flares, smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker Solusorb^R solvent adsorbent is recommended

Continued on Page: 4



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National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

A0446 -02

Acetone

Page: 4

Effective: 08/27/86

Issued: 09/04/86

SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)

for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: U002 (Toxic Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 5000 ppm, a gas mask with organic vapor cannister is recommended. Above this level, a self-contained breathing apparatus with full face shield is advised.

Eye/Skin Protection: Safety glasses with sideshields, butyl rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Red

Special Precautions

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Acetone
Hazard Class	Flammable liquid
UN/NA	UN1090
Labels	FLAMMABLE LIQUID

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Acetone
Hazard Class	3.1
UN/NA	UN1090
Labels	FLAMMABLE LIQUID

Continued on Page: 5

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

A0446 -02
Effective: 08/27/86

Acetone

Page: 5
Issued: 09/04/86

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

MLG Industries

2460 Boulevard Of The Generals
P.O. Box 945
Valley Forge, Pennsylvania 19482

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SO
EMERGENCY PHONE
800-345-6361
800-362-0534 (in PA)

MATERIAL
SAFETY
DATA SHE

105

PRODUCT NAME	CAS #
Compressed Air	N/A
TRADE NAME AND SYNONYMS	DOT ID. No.
Compressed Air; Air; Compressed Air, Breathing Quality	UN 1002
CHEMICAL NAME AND SYNONYMS	DOT Hazard Class:
See last page.	Nonflammable gas
	Formula:
	See last page.
ISSUE DATE AND REVISIONS	Chemical Family
25 November 1985	N/A

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT
None listed (ACGIH, 1985-86)
SYMPTOMS OF EXPOSURE
Air is nontoxic and necessary to support life. Inhalation of air in a high pressure environment such as underwater diving, caissons or hyperbaric chamber can result in symptoms similar to overexposure to pure oxygen. These include tingling of fingers and toes, abnormal sensations, impaired coordination and confusion. Decompression sickness pains or "bends" are possible following rapid decompression.

TOXICOLOGICAL PROPERTIES

High pressure effects (greater than two atmospheres of oxygen) are on the central nervous system. Improper decompression results in the accumulation of nitrogen in the blood.

RECOMMENDED FIRST AID TREATMENT

Facilities or practices at which air is breathed in a high pressure environment should be prepared to deal with the illnesses associated with decompression (bends or caisson disease). Decompression equipment may be required.

Information contained in this material safety data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition or matter or use.
Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

RESPIRATORY PROTECTION (Specify type)			
N/A			
VENTILATION	LOCAL EXHAUST	SPECIAL	
N/A	N/A		N/A
	MECHANICAL (Gen.)	OTHER	
	N/A		N/A
PROTECTIVE GLOVES			
Any material			
EYE PROTECTION			
Safety goggles or glasses			
OTHER PROTECTIVE EQUIPMENT			
Safety shoes			

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION	
DOT Shipping Name: Air, compressed	DOT Hazard Class: Nonflammable gas
DOT Shipping Label: Nonflammable gas	I.D. No.: UN 1002
SPECIAL HANDLING RECOMMENDATIONS	
<p>Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.</p> <p>For additional handling recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7 and G-7.1.</p>	
SPECIAL STORAGE RECOMMENDATIONS	
<p>Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.</p> <p>For additional storage recommendations, consult the Compressed Gas Association's Pamphlets P-1, G-7, and G-7.1.</p>	
SPECIAL PACKAGING RECOMMENDATIONS	
<p>Dry air is noncorrosive and may be used with all materials of construction. Moisture causes metal oxides which are formed with air to be hydrated so that they increase in volume and lose their protective role (rust formation). Concentrations of SO₂, Cl₂, salt, etc. in the moisture enhances the rusting of metals in air.</p>	
OTHER RECOMMENDATIONS OR PRECAUTIONS	
<p>Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).</p>	

CHEMICAL FORMULA: (Continued)

Atmospheric air which is compressed is composed of the following concentrations of gases:

<u>Gas</u>	<u>Molar %</u>
Nitrogen	78.09
Oxygen	20.94
Argon	0.93
Carbon Dioxide	0.033*
Neon	18.18×10^{-4}
Helium	5.239×10^{-4}
Krypton	1.139×10^{-4}
Hydrogen	0.5×10^{-4}
Xenon	0.086×10^{-4}
Radon	6×10^{-18}
Water vapor	Varying concentrations

*Concentrations may have slight variations.

Compressed air is also produced by reconstitution using only oxygen and nitrogen. This product contains 79 molar percent nitrogen and 21 molar percent oxygen plus trace amounts of other atmospheric gases which are present in the oxygen and nitrogen.

C5170 -01
Effective: 05/12/86

Copper

Page: 1
Issued: 05/12/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Copper
Formula: Cu
Formula Wt: 63.55
CAS No.: 07440-50-8
NIOSH/RTECS No.: GL5325000
Common Synonyms: Bronze Powder; C.I. 77400; Arwood Copper
Product Codes: 1732, 1736, 1720, 1714, 1728

PRECAUTIONARY LABELLING

BAKER SAF-T-DATATM System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
0	0	0	1
NONE	NONE	NONE	SLIGHT

Laboratory Protective Equipment



Precautionary Label Statements

CAUTION!
MAY CAUSE IRRITATION

During use avoid contact with eyes, skin, clothing. Wash thoroughly after handling. When not in use keep in tightly closed container.

SECTION II - HAZARDOUS COMPONENTS

<u>Component</u>	<u>CAS No.</u>
Copper	90-100 07440-50-8

SECTION III - PHYSICAL DATA

Boiling Point:	2595°C (4703°F)	Vapor Pressure(mmHg):	N/A
Melting Point:	1083°C (1981°F)	Vapor Density(air=1):	N/A
Specific Gravity: 8.92 (H ₂ O=1)		Evaporation Rate: (Butyl Acetate=1)	N/A

Continued on Page: 2



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Copper

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Effective: 05/12/86

Issued: 05/12/86

SECTION III - PHYSICAL DATA (Continued)

Solubility(H₂O): Negligible (less than 0.1 %) % Volatiles by Volume: 0

Appearance & Odor: Reddish, lustrous, malleable metal.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Toxic Gases Produced

copper fumes

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 1.0 mg/m³ (ppm)

Effects of Overexposure

Dust may cause sneezing and coughing.

Dust may irritate skin or eyes.

Prolonged exposure may cause dermatitis.

Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation.

Emergency and First Aid Procedures

INGESTION: If swallowed and the person is conscious, immediately give large amounts of water. Get medical attention.

INHALATION: If a person breathes in large amounts, move the exposed person to fresh air. Get medical attention.

EYE CONTACT: Immediately flush with plenty of water for at least 15 minutes. Get medical attention.

SKIN CONTACT: Immediately wash with plenty of soap and water for at least 15 minutes.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture

Incompatibles: strong acids, active halogen compounds, chlorine, fluorine, iodine, bromine, ammonia

Decomposition Products: copper fumes

J. I. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151

Chemrec # (800) 424-9300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

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Copper

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SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Carefully sweep up and remove.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration exceeds TLV, a dust/mist respirator is recommended. If concentration exceeds capacity of respirator, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety glasses with sideshields, proper gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA™ Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s. (Non-regulated)

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s. (Non-regulated)

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

Material Safety Data Sheet

May be used to comply with
 OSHA's Hazard Communication Standard,
 29 CFR 1910.1200. Standard must be
 printed for specific requirements.

U.S. Department of Labor
 Occupational Safety and Health Administration
 (Non-Mandatory Form)
 Form Approved
 OMB No. 1218-0072



IDENTITY (As Used on Label and List)
DIESEL FUEL (ALL GRADES)

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate this.

Section I

Manufacturer's Name Agway Petroleum Corporation	Emergency Telephone Number CHEMTREC: 800-424-9300
Address (Number, Street, City, State, and ZIP Code) PO Box 4852	Telephone Number for Information Same as above
Syracuse, NY 13221	Date Prepared June 1987
	Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identity Information CAS #: 068476-34-6

Hazardous Components (Specific Chemical Identity, Common Names)	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
DISTILLATES (PETROLEUM) - A COMPLEX COMBINATION OF HYDROCARBONS OBTAINED BY TREATING A PETROLEUM FRACTION WITH HYDROGEN IN THE PRESENCE OF A CATALYST, AND INCLUDES HYDROCARBON MOLECULES IN THE RANGE OF C9 THRU C16.				NONE ESTABLISHED 99.9+
PROPRIETARY ADDITIVES				NONE ESTABLISHED 0.1%

Section III — Physical/Chemical Characteristics

Boiling Point INITIAL (APPROXIMATE)	350°F - 370°F	Specific Gravity (H ₂ O = 1) AT 60°F	0.84-0.88
Vapor Pressure (mm Hg.) AT 68°F	0.4	Melting Point NA = NOT APPLICABLE	NA
Vapor Density (AIR = 1) 4.7		Evaporation Rate (BUNN APPROX = 1) (WATER = 1)	SLOWER
Solubility in Water NEGLIGIBLE			

Appearance and Odor

STRAW COLORED TO AMBER (MAY BE DYED GREEN); HYDROCARBON ODOR

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used) 125° MINIMUM (ASTM-D93)	Flammable Limits % VOLUME	LEL 0.7	UEL 5.0
---	-------------------------------------	-------------------	-------------------

Extinguishing Media

USE FOAM, DRY CHEMICAL, CO₂, OR WATER SPRAY

Special Fire Fighting Procedures

USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS, STRUCTURES, AND TO PROTECT

PERSONNEL. USE WATER TO FLUSH AWAY FROM IGNITION SOURCES (NOT INTO SEWER)

Unusual Fire and Explosion Hazards

IRRITATING OR TOXIC SUBSTANCES MAY BE EMITTED UPON THERMAL DECOMPOSITION.

EXPLOSION HAZARD FROM ENCLOSED AREAS OR CONTAINERS WHEN HEATED.

M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 22560

Page: 1

Product Name: DOWANOL (R) TMH GLYCOL ETHER

Effective Date: 06/08/90 Date Printed: 11/20/90

MSD: 001029

1. INGREDIENTS: (% w/w, unless otherwise noted)

Triethylene glycol monomethyl ether	CAS# 000112-35-6	(min) 65%
Diethylene glycol methyl ether	CAS# 000111-77-3	(max) 5%
Tetraethylene glycol methyl ether	CAS# 023783-42-8	(max) 24%
Pentaethylene glycol methyl ether	CAS# 023778-52-1	(max) 6%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: 450F, 232C
VAP PRESS: Approx. 0.01 mmHg @ 20C
VAP DENSITY: Approx. 6.4
SOL. IN WATER: Complete
SP. GRAVITY: 1.05
APPEARANCE: Clear to straw colored liquid.
ODOR: Information not available.

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: 255F, 124C
METHOD USED: PMCC

FLAMMABLE LIMITS

LFL: Not determined.
UFL: Not determined.

EXTINGUISHING MEDIA: Water fog, alcohol-resistant foam, CO2, dry chemical.

FIRE & EXPLOSION HAZARDS: Not available.

FIRE-FIGHTING EQUIPMENT: Wear positive-pressure, self-contained breathing apparatus.

Continued on Page 2)

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+ An Operating Unit Of The Dow Chemical Company

M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 22560
Product Name: DOWANOL (R) TMH GLYCOL ETHER

Page: 2

Effective Date: 06/08/90 Date Printed: 11/20/90 MSD: 001029

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Stable under normal storage conditions.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Oxidizing material.

HAZARDOUS DECOMPOSITION PRODUCTS: Combustion produces carbon dioxide and probably carbon monoxide.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Absorb material with suitable absorbent and collect for disposal; avoid release into fresh waters.

DISPOSAL METHOD: Burn in an approved incinerator in accordance with local, state, and federal requirements.

6. HEALTH HAZARD DATA:

EYE: Essentially non-irritating to eyes.

SKIN CONTACT: Prolonged or repeated exposure not likely to cause significant skin irritation.

SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The dermal LD50 has not been determined.

INGESTION: Single dose oral toxicity is low. The oral LD50 for rats is >3980 mg/kg. Amounts ingested incidental to industrial handling are not likely to cause injury; however ingestion of larger amounts may cause injury.

INHALATION: A single prolonged (hours) inhalation exposure is not likely to cause adverse effects.

SYSTEMIC & OTHER EFFECTS: A minor component, when studied

(Continued on Page 3)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 22560

Page: 3

Product Name: DOWANOL (R) TMH GLYCOL ETHER

Effective Date: 06/08/90 Date Printed: 11/20/90

MSD: 001029

1. HEALTH HAZARD DATA: (CONTINUED)

separately, caused liver, kidney and testicular effects in laboratory animals only following oral exposure. A minor component, when studied separately in laboratory animals, has been reported to cause slight toxic effects to the fetus at doses non-toxic to the mother. Birth defects have been reported only following high oral doses, exposures which have little relevance to humans.

2. FIRST AID:

EYES: Irrigate immediately with water for at least 5 minutes.

SKIN: Wash off in flowing water or shower.

INGESTION: Induce vomiting if large amounts are ingested.
Consult medical personnel.

INHALATION: Remove to fresh air if effects occur. Consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Supportive care.
Treatment based on judgment of the physician in response to reactions of the patient.

3. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE: Dow Industrial Hygiene Guide is 30 ppm for diethylene glycol ethyl ether.

VENTILATION: Good general ventilation should be sufficient for most conditions.

RESPIRATORY PROTECTION: For most conditions, no respiratory protection should be needed; however, in misty atmospheres, use an approved mist respirator.

SKIN PROTECTION: For brief contact, no precautions other than clean body-covering clothing should be needed. Use impervious gloves when prolonged or frequently repeated contact could occur.

Continued on Page 4)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 22560

Page: 4

Product Name: DOWANOL (R) TMH GLYCOL ETHER

Effective Date: 06/08/90

Date Printed: 11/20/90

MSD: 001029

5. HANDLING PRECAUTIONS: (CONTINUED)

EYE PROTECTION: Use safety glasses.

6. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE:

MSDS STATUS: Revised section 9 and regsheet.

Continued on Page 5)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 22560

Page: 5

Product Name: DOWANOL (R) TMH GLYCOL ETHER

Effective Date: 06/08/90

Date Printed: 11/20/90

MSD: 001029

REGULATORY INFORMATION: (Not meant to be all-inclusive-- selected regulations represented.)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS

=====

RA 313 INFORMATION: This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372:

CHEMICAL NAME	CAS NUMBER	CONCENTRATION
GLYCOL ETHERS		< 70 %

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

A delayed health hazard

(R) Indicates a Trademark of The Dow Chemical Company
The Information Herein Is Given In Good Faith, But No Warranty, Express Or Implied, Is Made. Consult The Dow Chemical Company Further Information.

* An Operating Unit Of The Dow Chemical Company



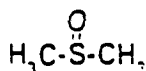
PRODUCT INFORMATION BULLETIN

DIMETHYL SULFOXIDE

Regulatory Agency Information
OSHA-DOTPREPARATION/REVISION DATE
S.R. Young / 8-88
317-19

Product Information Bulletin

MATERIAL SAFETY DATA SHEET



DIMETHYL SULFOXIDE: DMSO

SECTION I

MANUFACTURER'S NAME Gaylord Chemical Corporation	EMERGENCY TELEPHONE NO. 504-649-5. Chemtrec 800-424-9300
ADDRESS (Number, Street, City, and ZIP Code) P.O. Box 1209, Slidell, LA 70459-1209	
CHEMICAL NAME Dimethyl sulfoxide	COMMON NAME DMSO, Methyl sulfoxide
DOT CLASSIFICATION Combustible liquid, N. O. S.	FORMULA $\text{C}_2\text{H}_6\text{OS}$

SECTION II HAZARDOUS INGREDIENTS

CHEMICAL OR COMMON NAME	%	CAS NO.	APPLICABLE EXPOSURE LIMIT:	
			PEL - OSHA	TLV - ACGIH
Dimethyl sulfoxide	99+	67-68-5	none	none

CARCINOGENIC INGREDIENTS

CHEMICAL OR COMMON NAME	%	REFERENCE SOURCE			
		IARC	NTP	OSHA	OTHER
None identified					

SECTION III HEALTH HAZARD DATA

ACUTE HEALTH EFFECTS

Eyes - Can cause irritation or reddening.

Skin contact - DMSO is rapidly absorbed through the skin or mucuous membranes and may produce smarting, redness or contact dermatitis. It also produced garlic like breath, headache, sedation, diarrhea, and disturbances in color vision in some individuals after dermal contact. It accelerate the skin absorption of other materials including toxics.

Ingestion - Based on animal data, large oral dosages can produce bloody urine, kidney damage, or liver damage. The estimated mean lethal si dose in an adult human male exceeds 1 quart.

Inhalation - Headache, nausea, irritation, dizziness. Gross overexposures (more than 50,000 ppm) have produced chemical pneumonia and dea experimental animals.

CHRONIC HEALTH EFFECTS

Repeated skin exposure can result in allergic sensitization and scaling dermatitis. Dimethyl sulfoxide may accelerate the absorption of toxic materi through the skin. These materials may exhibit chronic health effects.

ROUTES OF ENTRY

Most common: skin and inhalation

Other: eye and ingestion

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Preexisting skin disease.

EMERGENCY AND FIRST AID PROCEDURES

Eyes - Flush thoroughly with running water (including under the eyelids) for at least 15 minutes. If irritation persists after flushing, seek medical atten

Skin - Remove contaminated clothing promptly (launder before reuse). Wash contaminated skin. Seek medical attention if irritation persists.

SECTION IV CHEMICAL DATA

BOILING POINT (°F)	272	SPECIFIC GRAVITY (H ₂ O=1)	1.096
VAPOR PRESSURE (mm Hg.)	3.68 @ 68°F	PERCENT VOLATILE BY VOLUME (%)	100
OR DENSITY (AIR=1)	2.7	EVAPORATION RATE (butyl acetate=1)	Not available
SOLUBILITY (Specify Solvents)	Miscible with water. Soluble in most organic solvents except straight chain (paraffinic) hydrocarbons.		

APPEARANCE AND ODOR

Colorless liquid. Mild characteristic ripe olive, vegetable odor.

SECTION V PHYSICAL HAZARD DATA

FLASH POINT (Method used)	FLAMMABLE LIMITS	LeI	Uel
192° F closed cup, autoignition temp 572°		3%	63%

EXTINGUISHING MEDIA

Water, foam, dry chemical or carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES

None identified.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Burning dimethyl sulfoxide produces poisonous gases (sulfur oxides, etc). Wear goggles, self-contained breathing apparatus, and rubber suit including gloves.

INCOMPATIBILITY (Materials to avoid)

Strong oxidizing agents (such as perchlorates) and alkali metals.

HAZARDOUS DECOMPOSITION PRODUCTS

Sulfur dioxides, formaldehyde, methyl mercaptan

CONDITIONS TO AVOID

HAZARDOUS POLYMERIZATION

MAY OCCUR

WILL NOT OCCUR X

STABILITY

UNSTABLE

STABLE

X

Prolonged heating at temperatures above 300°F

SECTION VI SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED

If a spill or leak occurs, immediately consult your environmental supervisor. Remove ignition sources. Ventilate the area. Do not breathe the vapor or get liquid in eyes or on skin/clothing. For large spills wear self-contained breathing apparatus with full facepiece and protective clothing. Dilute, and flush to wastewater treatment. Do not allow the material to enter streams or waterways.

WASTE DISPOSAL METHOD

Dilute and flush to an approved wastewater treatment system as per mill requirements. Bacterial decomposition of dimethyl sulfoxide during wastewater treatment can result in the release of dimethyl sulfide, a volatile substance with a strong disagreeable odor.

SECTION VII EXPOSURE CONTROL INFORMATION

RESPIRATORY PROTECTION (Specify type) Strong vapor or mist present.

Organic vapor chemical cartridge respirator

Vessel entry - Self contained or supplied air respirator with full facepiece.

VENTILATION

LOCAL EXHAUST

As needed

MECHANICAL (General)

General dilution

PROTECTIVE GLOVES

Butyl rubber

EYE PROTECTION

Safety glasses/Chemical goggles/Face shield

OTHER PROTECTIVE EQUIPMENT

Where splash or mist potential exists, wear chemical worker's goggles and rubber gloves. Other protective equipment such as aprons, rubber boots, face shield, or rubber suit may be needed. Eye wash stations and safety showers should be readily accessible near use areas.

OTHER ENGINEERING CONTROLS

None identified.

WORK PRACTICES

Do not smoke in areas of storage or use. Avoid all contact with skin and eyes.

HYGIENIC PRACTICES

Skin that becomes contaminated should be immediately washed (with soap or water) or showered. Employees who handle dimethyl sulfoxide should wash their hands before using other chemicals, eating, smoking, or using toilet facilities.

SECTION VIII SPECIAL PRECAUTIONS**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING**

Do not breathe vapors or mist. Avoid all contact with eyes or skin. Do not smoke in areas of storage or use. Wear the appropriate protective equipment. Store dimethyl sulfoxide away from oxidizing agents in a well ventilated, cool, and dry location far from sources of heat or ignition. Protect containers from physical damage.

MAINTENANCE PERSONNEL

Wash down vessels. Check the oxygen and combustible vapor content of the vessel atmosphere. Use the appropriate protective equipment.

SECTION IX HMIS LABEL**HEALTH**

2

FLAMMIBILITY

2

REACTIVITY

0

PERSONAL PROTECTION

8

DEPARTMENT OF TRANSPORTATION**Hazardous Materials Regulations, 49 CFR**

Proper Shipping Name: Combustible Liquid, NOS (Dimethyl Sulfoxide)

Hazard Class: Combustible Liquid

Reportable Quantity: None

Label Required (Drums): None

Placard Required (Bulk): None

Maximum Quantity, Aircraft: No Limit

Stowage on Vessels: Above or Below Deck

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

E5125 -01

Ethylene Glycol

Effective: 05/13/86

Page: 1
Issued: 05/13/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Ethylene Glycol
Formula: $\text{HOCH}_2\text{CH}_2\text{OH}$
Formula Wt: 62.07
CAS No.: 00107-21-1
NIOSH/RTECS No.: KW2975000
Common Synonyms: 1,2-Ethanediol; EG; Glycol; 1,2-Dihydroxyethane
Product Codes: 9140, L715, 9300, 5387

PRECAUTIONARY LABELLING

BAKER SAF-T-DATATM System



Laboratory Protective Equipment



Precautionary Label Statements

WARNING!
CAUSES IRRITATION
HARMFUL OR FATAL IF SWALLOWED

Avoid contact with eyes, skin, clothing.
Keep in tightly closed container. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

<u>Component</u>	<u>CAS No.</u>
Ethylene Glycol	90-100 00107-21-1

SECTION III - PHYSICAL DATA

Boiling Point:	197°C (387°F)	Vapor Pressure(mmHg):	0.06
Melting Point:	-13°C (9°F)	Vapor Density(air=1):	2.1

Continued on Page: 2

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemirec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

ES125 -01

Ethylene Glycol

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Issued: 05/13/86

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 1.12
(H₂O=1)

Evaporation Rate: 0.01
(Butyl Acetate=1)

Solubility(H₂O): Complete (in all proportions) % Volatiles by Volume: N/A

Appearance & Odor: Colorless, slightly viscous liquid with a mild odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: 111°C (232°F) NFPA 704M Rating: 1-1-0

Flammable Limits: Upper - 15.3 % Lower - 3.2 %

Fire Extinguishing Media

Use water spray, alcohol foam, dry chemical or carbon dioxide.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Use water to keep fire-exposed containers cool.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 125 mg/m³ (50 ppm)

Toxicity:	LD ₅₀ (oral-rat)(mg/kg)	-	4700
	LD ₅₀ (ipr-rat)(mg/kg)	-	5010
	LD ₅₀ (scu-rat)(mg/kg)	-	5300
	LD ₅₀ (iv-rat) (mg/kg)	-	3260

Effects of Overexposure

Inhalation of vapors may cause nausea, vomiting, lightheadedness or headache.

Liquid may be irritating to skin and eyes.

Skin absorption may be harmful.

Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation.

Ingestion may be fatal.

Chronic effects of overexposure may include damage to kidneys, liver, lungs, blood, or central nervous system.

Agency and First Aid Procedures

CALL A PHYSICIAN.

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Ethylene Glycol

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SECTION U - HEALTH HAZARD DATA (Continued)

If swallowed, if conscious, immediately induce vomiting.
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

SECTION UI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: flame, sources of ignition

Incompatibles: strong oxidizing agents, strong acids, strong bases, polymerization catalysts & accelerators

SECTION UII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Take up with sand or other noncombustible absorbent material and place into container for later disposal. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

SECTION UIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations above 50 ppm, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles, uniform, apron, rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

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**MATERIAL
SAFETY DATA
SHEET**

ES125 -01

Ethylene Glycol

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name Chemicals, n.o.s. (Non-regulated)

INTERNATIONAL (I.M.O.)

Proper Shipping Name Chemicals, n.o.s. (Non-regulated)

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

Section V — Reactivity Data

Stability	Unstable	Conditions to Avoid
	Stable	X

Compatibility (Materials to Avoid)

STRONG OXIDIZERS

Hazardous Decomposition or Byproducts

CO, CO2 AND REACTIVE HYDROCARBONS

Hazardous Polymerization	May Occur	Conditions to Avoid
	Will Not Occur	X

Section VI — Health Hazard Data

Routes of Entry:	Inhalation?	Skin?	Ingestion?
	YES: IF MIST OR VAPOR	POSSIBLE IRRITATION	YES

Health Hazards (Acute and Chronic)

POSSIBLE ASPIRATION HAZARD. MAY BE IRRITATING TO SKIN.

EYES OR RESPIRATORY TRACT. MAY AFFECT CENTRAL NERVOUS SYSTEM (SEE "SIGNS AND SYMPTOMS")

Carcinogenicity:	NTP?	IARC Monographs?	CSHA Regulated?
	NO DATA	NO DATA	NO DATA

Signs and Symptoms of Exposure

MAY INCLUDE IRRITATION, NAUSEA, VOMITING, DIARRHEA, EUPHORIA, EXCITATION, DIZZINESS, BLURRED VISION.

Medical Conditions

Generally Aggravated by Exposure THOSE RELATED TO DIFFICULTY IN BREATHING. ASPIRATION MAY

USE PNEUMONITIS (OIL PNEUMONIA)

Agency and First Aid Procedures

INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION. EYES: FLUSH AT ONCE WITH LARGE AMOUNTS OF WATER, HOLDING LIDS AWAY FROM EYEBALLS.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

RECOVER FREE LIQUID. ADD ABSORBENT MATERIAL TO SPILL AREAS. KEEP OUT OF STREAMS AND WATERWAYS. IMPLEMENT YOUR COMPANY'S EMERGENCY SPILL PROCEDURE.

Waste Disposal Method

INCINERATE ABSORBENT MATERIAL

Precautions to Be Taken in Handling and Storing

KEEP CONTAINERS CLOSED: KEEP AWAY FROM HEAT AND OPEN FLAMES

Other Precautions

AVOID BREATHING MIST OR VAPORS. REMOVE OIL SOAKED CLOTHING AND WASH SKIN WITH SOAP AND WATER

Section VIII — Control Measures

Respiratory Protection (Specify Type)

NORMALLY NOT NEEDED

Ventilation	Local Exhaust	General
	ONLY IF HOT FUMES EXIST	NO
	Mechanical (General)	Other
	NO	NO

Protective Gloves

YES

Eye Protection

YES, IF SPLASH, SPRAY OR MIST ARE POSSIBLE

Other Protective Clothing or Equipment

AS NEEDED TO PREVENT SKIN CONTACT

Hygienic Practices

WASH AREAS OF CONTACT WITH SOAP AND WATER

Helium Material Safety Data Sheet

Industrial Gas Division
Air Products and Chemicals, Inc.
Allentown, PA 18185
Tel. (215) 481-4911 • TWX 510-651-3686
Telecopy (215) 481-5900
CABLE-AIRPROD • TELEX 847416

AIR
PRODUCTS

EMERGENCY PHONE: 800—523-9374		IN PENNSYLVANIA: 800—322-9082	
ISSUE DATE	Issued: 13 April 1977	TRADE NAME AND SYNONYMS	CHEMICAL NAME AND SYNONYMS
		Helium, or Liquid Helium	Helium
REVISIONS	Rev: 1 June 1990	FORMULA	CHEMICAL FAMILY
		He MW: 4.003	Inert gas CAS#7440-59-7

HEALTH HAZARD DATA

EXPOSURE LIMITS

OSHA: None established. ACGIH: Simple Asphyxiant. Helium is not listed as a carcinogen by NTP, IARC, or OSHA.

SYMPTOMS IF INGESTED, CONTACTED WITH SKIN, OR VAPOR INHALED

Helium is odorless and nontoxic, but may produce suffocation by diluting the concentration of oxygen in air below levels necessary to support life. **PERSONNEL, INCLUDING RESCUE WORKERS, SHOULD NOT ENTER AREAS WHERE THE OXYGEN CONCENTRATION IS BELOW 19.5%, UNLESS PROVIDED WITH A SELF-CONTAINED BREATHING APPARATUS OR AIRLINE RESPIRATOR.** Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. Death may result from errors in judgment, confusion, or loss of consciousness which prevents self-rescue. At low oxygen concentrations unconsciousness and death may occur in seconds without warning. Extensive tissue damage or burns can result from exposure to liquid helium or cold helium vapors.

TOXICOLOGICAL PROPERTIES

Helium is nontoxic but can act as a simple asphyxiant by displacing the amount of oxygen in air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

Persons suffering from lack of oxygen should be moved to areas with normal atmospheres. **SELF-CONTAINED BREATHING APPARATUS MAY BE REQUIRED TO PREVENT ASPHYXIATION OF RESCUE WORKERS.** Assisted respiration and supplemental oxygen should be given if the victim is not breathing. If cryogenic liquid or cold boil-off gas contacts a worker's skin or eyes, frozen tissues should be flooded or soaked with tepid water (105–115°F; 41–46°C). **DO NOT USE HOT WATER.** Cryogenic burns which result in blistering or deeper tissue freezing should be seen promptly by a physician.

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used) N/A	AUTO IGNITION TEMP N/A	FLAMMABLE LIMITS N/A	LEL N/A	UEL N/A
EXTINGUISHING MEDIA N/A			ELECTRICAL CLASSIFICATION GROUP N/A	
SPECIAL FIRE FIGHTING PROCEDURES N/A				
UNUSUAL FIRE AND EXPLOSION HAZARDS Cylinder(s) exposed to intense heat or fire may vent rapidly or explode.				

PHYSICAL DATA

BOILING POINT (°F)		FREEZING POINT (°F)	
@ 1 atm -452.1F (-268.9C)		@ 967 psia -458.0F (-272.0C)	
VAPOR PRESSURE (psia)		SOLUBILITY IN WATER	
N/A		@ 68F (20C), 1 atm 0.861% by volume	
VAPOR DENSITY (lb/cu ft)	SPECIFIC GRAVITY (AIR=1)	LIQUID DENSITY (lb/cu ft)	SPECIFIC GRAVITY (H ₂ O=1)
@ 32F (0C), 1 atm 0.01114	@ 32F (0C), 1 atm 0.138	@ boiling point, 1 atm 7.798	@ boiling point, 1 atm 0.125
APPEARANCE AND ODOR			
Helium is colorless and odorless in both gaseous and liquid states.			

REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID
	STABLE	X	None
INCOMPATIBILITY (Materials to avoid)			HAZARDOUS DECOMPOSITION PRODUCTS
None			None
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID
	WILL NOT OCCUR	X	None
SPILL OR LEAK PROCEDURES			
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED Avoid contact of skin with liquid helium or its cold boil-off gas. Flush liquid spill with water to disperse. Ventilate enclosed areas to prevent formation of oxygen-deficient atmospheres caused by evaporation of liquid helium or the release of gaseous helium.			
WASTE DISPOSAL METHOD Allow liquid helium to evaporate in a well-ventilated location remote from work areas. Vent helium gas slowly to a well-ventilated outdoor location remote from work areas. Do not attempt to dispose of residual helium in compressed gas cylinders. Return cylinders to Air Products with residual pressure, the cylinder valve tightly closed and valve cap in place.			
SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type) Use self-contained breathing apparatus in oxygen-deficient atmospheres. Caution! Air purifying respirators will not function. Their use may result in asphyxiation.			
VENTILATION Natural or mechanical where gas is present.	LOCAL EXHAUST As necessary MECHANICAL (General) As necessary		SPECIAL Only as necessary OTHER Vents should be situated to avoid higher than normal concentration of helium in work areas.
PROTECTIVE GLOVES Loose fitting gloves of impermeable material, such as leather are recommended when handling liquid. Leather work gloves are recommended when handling compressed gas cylinders.			
EYE PROTECTION Safety glasses are recommended when handling high-pressure cylinders. Use chemical goggles or a face shield with safety glasses when handling liquid.			
OTHER PROTECTIVE EQUIPMENT None			
SPECIAL PRECAUTIONS*			
SPECIAL LABELING INFORMATION DOT Shipping Name: Helium, or Helium Compressed; (Liquid) Helium, refrigerated liquid. DOT Hazard Class: Nonflammable Gas. DOT Shipping Label: Nonflammable Gas. I.D. Number: UN 1046 (Helium, Helium Compressed); UN 1963 (Liquid Helium).			
SPECIAL HANDLING RECOMMENDATIONS Prevent contact of liquid helium or cold boil-off gas with exposed skin. Prevent entrapment of liquid in closed systems. Use only in well-ventilated areas. Compressed gas cylinders contain helium at extremely high pressure and should be handled with care. Use a pressure-reducing regulator when connecting to lower pressure piping systems. Secure cylinders when in use. Never use direct flame to heat a compressed gas cylinder. Use a check valve to prevent back flow into storage container. Avoid dragging, rolling, or sliding cylinders, even for a short distance. Use a suitable hand truck. For additional handling recommendations on compressed gas cylinders, consult Compressed Gas Association Pamphlet P-1.			
SPECIAL STORAGE RECOMMENDATIONS Store liquid containers and cylinders in well-ventilated areas. Keep cylinders away from sources of heat. Storage should not be in heavy traffic areas to prevent accidental knocking over or damage from passing or falling objects. Valve caps should remain on cylinders not connected for use. Segregate full and empty cylinders. Storage areas should be free of combustible material. Avoid exposure to areas where salt or corrosive chemicals are present. See Compressed Gas Association Pamphlet P-1 for additional storage recommendations.			
SPECIAL PACKAGING RECOMMENDATIONS Gaseous helium containers meet DOT specifications or American Society of Mechanical Engineers (ASME) codes. Liquid helium is stored in vacuum-insulated containers meeting DOT specifications or ASME codes.			
OTHER RECOMMENDATIONS OR PRECAUTIONS Liquid helium in exposed piping can actually cause air to condense and liquefy. The nitrogen in this liquid can evaporate more rapidly, leaving an oxygen enriched liquid behind. Utilize oxygen-compatible insulating materials and minimize exposed piping surface areas. Use only metals and materials compatible with extremely low temperatures. Avoid use of carbon steel and other metals which become brittle at low temperatures. Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder filled without the permission of the owner is a violation of Federal Law. If oxygen-deficient atmospheres are suspected or can occur, use oxygen monitoring equipment to test for oxygen-deficient atmospheres.			
*Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Food and Drug Administration and others) may have specific regulations concerning the transportation handling, storage or use of this product which will not be reflected in this data sheet. The customer should review these regulations to ensure that s/he is in full compliance.			

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemtec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

H2379 -02
Effective: 10/15/85

Hexanes

Page: 1
Issued: 10/16/85

SECTION I - PRODUCT IDENTIFICATION

Product Name: Hexanes
Formula: C_6H_{14}
Formula Wt: 86.18
CAS No.: 00110-54-3
NIOSH/RTECS No.: MN9275000
Common Synonyms: Normal Hexane; Hexyl Hydride
Product Codes: 9262, 9310, 9304, 9306, N169, 9309, N168, 9303

PRECAUTIONARY LABELLING

BAKER SAF-T-DATATM System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
1	3	0	1
SLIGHT	SEVERE	NONE	SLIGHT

Laboratory Protective Equipment



Precautionary Label Statements

DANGER!
EXTREMELY FLAMMABLE
CAUSES IRRITATION

Keep away from heat, sparks, flame.
Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. In case of fire, use water spray, alcohol foam, dry chemical, or carbon dioxide. Flush spill area with water spray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Hexanes	90-100	110-54-3

SECTION III - PHYSICAL DATA

Boiling Point: 69°C (156°F) Vapor Pressure(mmHg): 124
Melting Point: -95°C (-139°F) Vapor Density(air=1): 3.0

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J. T. Baker Chemical Co.

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**MATERIAL
SAFETY DATA
SHEET**

H2379 -02

Effective: 10/15/85

Hexanes

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SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 0.66
(H₂O=1)

Evaporation Rate: 9
(Butyl Acetate=1)

Solubility(H₂O): Negligible (less than 0.1 %) % Volatiles by Volume: 100

Appearance & Odor: Colorless liquid with mild odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: -22°C (-7°F) NFPA 704M Rating: 1-3-0

Flammable Limits: Upper - 7.5 % Lower - 1.1 %

Fire Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.
(Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 180 mg/m³ (50 ppm)

Toxicity: LD₅₀ (oral-rat)(g/kg) - 28.7

Effects of Overexposure

Overexposure to vapors may cause irritation of mucous membranes, dryness of mouth and throat, headache, nausea and dizziness.

Emergency and First Aid Procedures

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

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J. T. Baker Chemical Co.

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MATERIAL SAFETY DATA SHEET

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Hexanes

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SECTION VI - REACTIVITY DATA (Continued)

Conditions to Avoid: heat, sources of ignition, flame

Incompatibles: strong oxidizing agents, chlorine, fluorine,
magnesium perchlorate

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Shut off ignition sources; no flares, smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.

J. T. Baker Solusorb^R solvent adsorbent is recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D001* (Ignitable Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety glasses with sideshields, neoprene gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Red

Special Precautions

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

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MATERIAL SAFETY DATA SHEET

H2379 -02

Hexanes

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Effective: 10/15/85

Issued: 10/16/85

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hexane
Hazard Class	Flammable liquid
UN/NA	UN1208
Labels	FLAMMABLE LIQUID

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hexane, and its isomers
Hazard Class	3.1
UN/NA	UN1208
Labels	FLAMMABLE LIQUID

N/A - Not Applicable or Not Available

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National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

H3883 -02

Effective: 08/07/86

Hydrochloric Acid, 1N

Page: 1

Issued: 08/15/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Hydrochloric Acid, 1N

Formula: HCl in H₂O

Formula Wt: 36.46

CAS No.: 07647-01-0

Product Codes: 5620

PRECAUTIONARY LABELLING

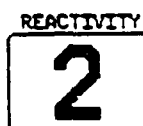
BAKER SAF-T-DATATM System



SEVERE



NONE



MODERATE



SEVERE

Laboratory Protective Equipment



GOGGLES & SHIELD



LAB COAT & APRON



VENT HOOD



HEAVY GLOVES

Precautionary Label Statements

POISON! DANGER!
CAUSES BURNS

MAY BE FATAL IF SWALLOWED OR INHALED

Do not get in eyes, on skin, on clothing.

Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

<u>Component</u>	<u>%</u>	<u>CAS No.</u>
Hydrogen Chloride	3-4	7647-01-0

SECTION III - PHYSICAL DATA

Boiling Point:	N/A	Vapor Pressure(mmHg):	N/A
Melting Point:	N/A	Vapor Density(air=1):	1.3
Specific Gravity: (H ₂ O=1)	1.19	Evaporation Rate: (Butyl Acetate=1)	N/A

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J. T. Baker Chemical Co.

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MATERIAL SAFETY DATA SHEET

3883 -02

Hydrochloric Acid, 1N

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Effective: 08/07/86

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SECTION III - PHYSICAL DATA (Continued)

Solubility(H₂O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Colorless liquid with hydrogen chloride odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A NFPA 704M Rating: 3-0-0

Flammable Limits: Upper - N/A % Lower - N/A %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area, if it can be done without risk. Use water to keep fire exposed containers cool; do not get water inside containers.

Unusual Fire & Explosion Hazards

Closed containers exposed to heat may explode.

Toxic Gases Produced

hydrogen chloride, hydrogen gas

SECTION V - HEALTH HAZARD DATA

PEL and TLV listed denote ceiling limit.

Threshold Limit Value (TLV/TWA): 7 mg/m³ (5 ppm)

Permissible Exposure Limit (PEL): 7 mg/m³ (5 ppm)

Toxicity: LD₅₀ (ipr-mouse)(mg/kg) - 40
LD₅₀ (oral-rabbit)(mg/kg) - 900
LC₅₀ (inh1-rat-1H) (ppm) - 3124

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause pulmonary edema, circulatory system collapse, damage to upper respiratory system, collapse.

Inhalation of vapors may cause coughing and difficult breathing.

Liquid may cause severe burns to skin and eyes.

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H3883 -02

Hydrochloric Acid, 1N

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SECTION V - HEALTH HAZARD DATA (Continued)

Ingestion is harmful and may be fatal.
Ingestion may cause severe burning to mouth and stomach.
Ingestion may cause nausea and vomiting.

Medical Conditions Generally Aggravated By Exposure
None Identified

Routes Of Entry

ingestion, inhalation, skin contact, eye contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, do NOT induce vomiting; if conscious, give water, milk, or milk of magnesia.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Wash clothing before re-use.

Toxicity test results and safety and health effects are based on the solute.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Incompatibles: most common metals, strong bases, metal oxides, amines, carbonates

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean, dry container and cover; remove from area. Flush spill area with water.

J. T. Baker Neutrasorb^R or Neutrasol^R "Low Na+" acid neutralizers are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number:

D002 (Corrosive Waste)

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

H3883 -02

Hydrochloric Acid, 1N

Page: 4

Effective: 08/07/86

Issued: 08/15/86

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 100 ppm, a chemical cartridge respirator with acid cartridge is recommended. Above this level, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hydrochloric acid
Hazard Class	Corrosive material (liquid)
UN/NA	UN1789
Labels	CORROSIVE
Reportable Quantity	5000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hydrochloric acid, solution
Hazard Class	8
UN/NA	UN1789
Labels	CORROSIVE

N/A = Not Applicable or Not Available

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MATERIAL SAFETY DATA SHEET

H3880 -02

Hydrochloric Acid

Page: 1
Issued: 08/15/86

Effective: 08/07/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Hydrochloric Acid
Formula: HCl
Formula Wt: 36.46
CAS No.: 7647-01-0
NIOSH/RTECS No.: MW4025000
Common Synonyms: Muriatic Acid; Chlorohydric Acid; Hydrochloride
Product Codes: 9543, 9539, 9535, 5367, 9534, 9544, 9529, 9542, 4800, 9549, 9530, 9548, 9540, 9547, 9546, 9537

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

POISON! DANGER!
CAUSES SEVERE BURNS
MAY BE FATAL IF SWALLOWED OR INHALED

Do not get in eyes, on skin, on clothing.
Do not breathe vapor. Keep in tightly closed container. Loosen closure cautiously. Use with adequate ventilation. Wash thoroughly after handling. In case of spill neutralize with soda ash or lime and place in dry container.

SECTION II - HAZARDOUS COMPONENTS

Component	3	CAS No.
Hydrochloric Acid (23° Baume)	35-40	7647-01-0

SECTION III - PHYSICAL DATA

Boiling Point: 110°C (230°F) Vapor Pressure(mmHg): N/A

Continued on Page: 2

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**MATERIAL
SAFETY DATA
SHEET**

3880 -02

Hydrochloric Acid

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SECTION III - PHYSICAL DATA (Continued)

Boiling Point: -25°C (-13°F)

Vapor Density (air=1): 1.3

Specific Gravity: 1.19
(H₂O=1)

Evaporation Rate: N/A
(Butyl Acetate=1)

Solubility (H₂O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Clear, colorless or slightly yellow, pungent, fuming liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

NEPA 704M Rating: 3-0-0

Flammable Limits: Upper - N/A % Lower - N/A %

Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool. Do not get water inside containers.

Unusual Fire & Explosion Hazards

May emit hydrogen gas upon contact with metal.

Toxic Gases Produced

hydrogen chloride, hydrogen gas

SECTION V - HEALTH HAZARD DATA

PEL and TLV listed denote ceiling limit.

Threshold Limit Value (TLV/TWA): 7 mg/m³ (5 ppm)

Permissible Exposure Limit (PEL): 7 mg/m³ (5 ppm)

Toxicity: LD₅₀ (oral-rabbit)(mg/kg) - 900

LD₅₀ (ipr-mouse)(mg/kg) - 40

LC₅₀ (inhl-rat-1H) (ppm) - 3124

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SAFETY DATA
SHEET**

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Effective: 08/07/86

Hydrochloric Acid

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SECTION V - HEALTH HAZARD DATA (Continued)

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause pulmonary edema, circulatory system collapse, damage to upper respiratory system, collapse.
Inhalation of vapors may cause coughing and difficult breathing.
Liquid may cause severe burns to skin and eyes.
Ingestion is harmful and may be fatal.
Ingestion may cause severe burning to mouth and stomach.
Ingestion may cause nausea and vomiting.

Routes Of Entry

ingestion, inhalation, skin contact, eye contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, do NOT induce vomiting; if conscious, give water, milk, or milk of magnesia.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

Wash clothing before re-use.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, moisture

Incompatibles:

most common metals, water, amines, metal oxides,
acetic anhydride, propiolactone, vinyl acetate,
mercuric sulfate, calcium phosphide, formaldehyde,
alkalies, carbonates, strong bases,
sulfuric acid, chlorosulfonic acid

Decomposition Products: hydrogen chloride, hydrogen, chlorine

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing. Stop leak if you can do so without risk. Ventilate area. Neutralize spill with soda ash or lime. With clean shovel, carefully place material into clean dry container and cover; remove from area. Flush spill area with water.

J. T. Baker Neutrasorb^R or Neutrasol^R "Low Na+" acid neutralizers

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

38U -02

Hydrochloric Acid

Effective: 08/07/86

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Issued: 08/15/86

SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)

are recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

Hazardous Waste Number: D002 (Corrosive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 100 ppm, a chemical cartridge respirator with acid cartridge is recommended. Above this level, a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, acid-resistant gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

MSDS DATATM Storage Color Code: White

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.
Isolate from incompatible materials.
Do not store near oxidizing materials.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hydrochloric acid
Hazard Class	Corrosive material (liquid)
UN/NA	UN1789
Labels	CORROSIVE
Reportable Quantity	5000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hydrochloric acid, solution
Hazard Class	8
UN/NA	UN1789
Labels	CORROSIVE

J. T. Baker Chemical Co.

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24-Hour Emergency Telephone - (201) 859-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

H3880 -02

Hydrochloric Acid

Effective: 08/07/86

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N/A - Not Applicable or Not Available

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Welding Products

Division of The BOC Group, Inc.

575 Mountain Avenue
Murray Hill
New Jersey 07974
Telephone: 201-464-8100
TWX: 710-984-7970

Material Safety Data Sheet

Distributor:
Findley Welding Supply, Inc.

PRODUCT NAME

HYDROGEN

SYNONYMS

None

FORMULA

H₂

CHEMICAL FAMILY

Gas

ISSUE DATE

AND REVISIONS 11/1/84

CAS NUMBER

133-74-0

DOT HAZARD CLASS

Flammable Gas

DOT IDENTIFICATION NUMBER

UN 1964 & UN 1965

CHEMTREC

800-424-9300

HAZARDOUS INGREDIENTS WT. %

TLV*

WT %

TLV*

Hydrogen

100%

None (1)

(1) Simple Asphyxiant, ACGIH 1984 ed.

PHYSICAL DATA

Boiling Point

-432°F

Liquid Density at Boiling Pt.

4.43

Vapor Pressure

Gas Density

N/A

.084

Solubility in Water

Specific Gravity

Slight

2.02

Appearance and Odor

Colorless, Odorless Gas.

FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used)

Flammable Limits

Ignition Temp. 932°F

LEL 4.1 % UEL 74.2 %

Extinguishing Media

Water Fog

Special Fire Fighting Procedures

Cool burning cylinder to prevent explosion. If flame is extinguished, continue to cool cylinder until contents are expended. Flame is nonluminous.

Material Safety Data Sheet (G-2)

HYDROGEN

HEALTH HAZARD DATA

Non-Toxic Simple Asphyxiant. Can cause unconsciousness and death without warning if present in quantity sufficient to dilute oxygen content below 19%.

Recommended First Aid Treatment - Remove to fresh air and provide oxygen. Obtain medical attention and artificial respiration if breathing has stopped.

REACTIVITY DATA

Stability
Unstable

Conditions to Avoid
None

Stable X

Incompatibility (Materials to avoid)

Can react vigorously with oxidizing materials..

Hazardous Polymerization
May Occur

Conditions to Avoid

Will Not Occur

X

SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled - Remove cylinder to safe outdoor location and, if possible, allow contents to vent to atmosphere. Keep away from all sources of ignition.

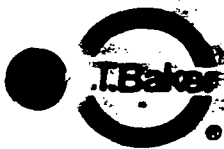
Waste Disposal Method - Vent to atmosphere at slow rate in safe outdoor location. Remove all valves and allow cylinder to continue venting.

SPECIAL PROTECTION INFORMATION

Not normally required. Do not enter area of high gas concentrations until first purging with inert gas and then ventilating with air.

Storage Recommendations

Keep cylinders stored away from oxidizing materials. Keep away from direct heat and open flame. Secure all cylinders in an upright position and protect from physical damage. Refer to NFPA #58-1983 and CGA-P1, "Safe Handling of Compressed Gases", or OSHA 1910 Subpart H and Subpart Q.



J. T. Baker Chemical Co.

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Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL
SAFETY DATA
SHEET

18840 -02
Effective: 09/03/86

Isopropyl Alcohol

Page: 1
Issued: 09/04/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Isopropyl Alcohol
Formula: $\text{CH}_3\text{CHOHCH}_3$
Formula Wt: 60.10
CAS No.: 00067-63-0
NIOSH/RTECS No.: NT805000
Common Synonyms: 2-Propanol; Isopropanol; sec-Propyl Alcohol; IPA;
Dimethylcarbinol
Product Codes: U298,5082,9080

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
			
SLIGHT	SEVERE	SLIGHT	SLIGHT

Laboratory Protective Equipment



Precautionary Label Statements

WARNING!
FLAMMABLE

CAUSES IRRITATION

HARMFUL IF SWALLOWED OR INHALED

Keep away from heat, sparks, flame. Avoid contact with eyes, skin, clothing. Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling. In case of fire, use alcohol foam, dry chemical, carbon dioxide - water may be ineffective. Flush spill area with water spray.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Isopropyl Alcohol	90-100	67-63-0

Continued on Page: 2



J. T. Baker Chemical Co.

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Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

19840 -02

Isopropyl Alcohol

Page: 2

Effective: 09/03/86

Issued: 09/04/86

SECTION III - PHYSICAL DATA

Boiling Point: 82°C (180°F) Vapor Pressure(mmHg): 33
Melting Point: -89°C (-128°F) Vapor Density(air=1): 2.1
Specific Gravity: 0.79 Evaporation Rate: 2.83
(H₂O=1) (Butyl Acetate=1)
Solubility(H₂O): Complete (in all proportions) % Volatiles by Volume: 100

Appearance & Odor: Colorless liquid with slight odor of rubbing alcohol.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Closed Cup): 12°C (53°F) NFPA 704M Rating: 1-3-0
Flammable Limits: Upper - 12.0 % Lower - 2.0 %

Fire Extinguishing Media

Use alcohol foam, dry chemical or carbon dioxide.
(Water may be ineffective.)

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire.

Toxic Gases Produced

carbon monoxide, carbon dioxide

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 980 mg/m³ (400 ppm)

Short-Term Exposure Limit (STEL): 1225 mg/m³ (500 ppm)

Permissible Exposure Limit (PEL): 980 mg/m³ (400 ppm)

Toxicity: LD₅₀ (oral-rat)(mg/kg) - 5045

LD₅₀ (ipr-mouse)(mg/kg) - 933

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J. T. Baker Chemical Co.

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National Response Center # (800) 424-8802

MATERIAL SAFETY DATA SHEET

I8840 -02

Isopropyl Alcohol

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Issued: 09/04/86

SECTION U - HEALTH HAZARD DATA (Continued)

LD₅₀ (skn-rabbit) (g/kg) - 13
LD₅₀ (iv-mouse) (mg/kg) - 1863

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause headache, nausea, vomiting, dizziness, drowsiness, irritation of respiratory tract, and loss of consciousness. Inhalation of vapors may cause pulmonary edema.
Liquid may be irritating to skin and eyes. Prolonged skin contact may result in dermatitis. Eye contact may result in temporary corneal damage. Ingestion may cause nausea, vomiting, headaches, dizziness, gastrointestinal irritation. Ingestion may cause central nervous system depression.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, do NOT induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, flame, other sources of ignition

Incompatibles: strong oxidizing agents, aluminum, nitric acid, sulfuric acid, amines and ammonia, halogen acids and halogen compounds

Decomposition Products: carbon monoxide, carbon dioxide

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Shut off ignition sources; no flares, smoking, or flames in area. Stop leak if you can do so without risk. Use water spray to reduce vapors. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush

Continued on Page: 4



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MATERIAL SAFETY DATA SHEET

I8840 -02

Isopropyl Alcohol

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SECTION VII - SPILL AND DISPOSAL PROCEDURES (Continued)

area with water.

J. T. Baker Solusorb^R solvent adsorbent is recommended for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number: D001 (Ignitable Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles, uniform, apron, neoprene gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Red

Special Precautions

Bond and ground containers when transferring liquid. Keep container tightly closed. Store in a cool, dry, well-ventilated, flammable liquid storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Isopropanol
Hazard Class	Flammable liquid
UN/NA	UN1219
Labels	FLAMMABLE LIQUID

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Isopropanol
Hazard Class	3.2

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MATERIAL SAFETY DATA SHEET

I8840 -02

Isopropyl Alcohol

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)

UN/NA
Labels

UN1219
FLAMMABLE LIQUID

N/A - Not Applicable or Not Available

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Material Safety Data Sheet

be used to comply with
the Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072



IDENTITY (As Used on Label and List)

KEROSENE

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate this.

Section I

Manufacturer's Name

Agway Petroleum CorporationEmergency Telephone Number **CHEMTREC: 800-424-9300****AGWAY:**

Address (Number, Street, City, State, and ZIP Code)

Telephone Number for Information

Same as above

Date Prepared

June 1987

Signature of Preparer (optional)

PO Box 4852**Syracuse, NY 13221**

Section II — Hazardous Ingredients/Identity Information

CAS #: **8008-20-6**

Hazardous Components (Specific Chemical Identity, Common Name(s))

OSHA PEL

ACGIH TLV

Other Limits
Recommended

% (optional)

A COMPLEX COMBINATION OF HYDROCARBONS**PRODUCED BY DISTILLING CRUDE OIL. IT****INCLUDES HYDROCARBON MOLECULES IN THE****RANGE OF C9 THROUGH C210.****NONE ESTABLISHED****99.9+****REMAINING COMPONENTS NOT DETERMINED****HAZARDOUS AND/OR PRESENT AT LESS****THAN 1% (0.1% FOR CARCINOGENS)****NOT APPLICABLE****TRACE**

Section III — Physical/Chemical Characteristics

Boiling Point

INITIAL (APPROXIMATE)**350°F**Specific Gravity (H₂O = 1)**(APPROXIMATE) AT 60°F****0.825**

Vapor Pressure (mm Hg.)

AT 68°F**0.4**

Melting Point

NA = NOT APPLICABLE**NA**

Vapor Density (AIR = 1)

4.7

Evaporation Rate

(Butyl Acetate = 1) (WATER = 1)**SLOWER**

Solubility in Water

NEGLECTIBLE

Appearance and Odor

COLOPLESS OR FAINTLY STRAW COLORED LIQUID; HYDROCARBON ODOR.

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)

MINIMUM 100°F (ASTM-D93)

Flammable Limits

% VOLUME

LEL

0.7

UEL

5.0

Extinguishing Media

USE FOAM, DRY CHEMICAL, CO2, OR WATER SPRAY

Special Fire Fighting Procedures

USE WATER SPRAY TO COOL FIRE-EXPOSED CONTAINERS, STRUCTURES, AND TO PROTECT**PERSONNEL. USE WATER TO FLUSH AWAY FROM IGNITION SOURCES (NOT INTO SEWER)**

Unusual Fire and Explosion Hazards

IRRITATING OR TOXIC SUBSTANCES MAY BE EMITTED UPON THERMAL DECOMPOSITION.**EXPLOSION HAZARD FROM ENCLOSED AREAS OR CONTAINERS WHEN HEATED.**

Section V — Reactivity Data

Stability	Unstable	Conditions to Avoid
	Stable	X

Incompatibility (Materials to Avoid)

STRONG OXIDIZERS

Hazardous Decomposition or Byproducts

CO, CO2 AND REACTIVE HYDROCARBONS

Hazardous Polymerization	May Occur	Conditions to Avoid
	Will Not Occur	X

Section VI — Health Hazard Data

Routes of Entry:	Inhalation?	Skin?	Ingestion?
	YES: IF MIST OR VAPOR	POSSIBLE IRRITATION	YES

Health Hazards (Acute and Chronic)

POSSIBLE ASPIRATION HAZARD. MAY BE IRRITATING TO SKIN.

EYES OR RESPIRATORY TRACT. MAY AFFECT CENTRAL NERVOUS SYSTEM (SEE "SIGNS AND SYMPTOMS")

Carcinogenicity:	NTP?	IARC Monographs?	CSHA Regulated?
	NO DATA	NO DATA	NO DATA

Signs and Symptoms of Exposure

MAY INCLUDE IRRITATION, NAUSEA, VOMITING, DIARRHEA, EUPHORIA, EXCITATION, DIZZINESS, BLURRED VISION.

Medical Conditions

Generally Aggravated by Exposure THOSE RELATED TO DIFFICULTY IN BREATHING. ASPIRATION MAY CAUSE PNEUMONITIS (OIL PNEUMONIA)

Emergency and First Aid Procedures

INGESTION: DO NOT INDUCE VOMITING. GET IMMEDIATE MEDICAL ATTENTION. EYES: FLUSH AT ONCE WITH LARGE AMOUNTS OF WATER, HOLDING LIDS AWAY FROM EYEBALLS.

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

RECOVER FREE LIQUID. ADD ABSORBENT MATERIAL TO SPILL AREAS. KEEP OUT OF STREAMS AND WATERWAYS. IMPLEMENT YOUR COMPANY'S EMERGENCY SPILL PROCEDURE.

Waste Disposal Method

INCINERATE ABSORBENT MATERIAL

Precautions to Be Taken in Handling and Storing

KEEP CONTAINERS CLOSED: KEEP AWAY FROM HEAT AND OPEN FLAMES

Other Precautions

AVOID BREATHING MIST OR VAPORS. REMOVE OIL SOAKED CLOTHING AND WASH SKIN WITH SOAP AND WATER

Section VIII — Control Measures

Respiratory Protection (Specify Type)

NORMALLY NOT NEEDED

Ventilation	Local Exhaust	Special
	ONLY IF HOT FUMES EXIST	NO
	Mechanical (General)	Other
	NO	NO

Protective Gloves

YES

Eye Protection

YES, IF SPLASH, SPRAY OR MIST ARE PC

Other Protective Clothing or Equipment

AS NEEDED TO PREVENT SKIN CONTACT

Work Hygiene Practices

WASH AREAS OF CONTACT WITH SOAP AND WATER

DATE: 07/29/89
INDEX: 11892070573

ACQ# 224777-02
CAT NO: A4124

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PO NBR: 10555

EMMETHANOLXX
EMMETHANOLXX
EMMETHANOLXX

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY CONTACTS:
GASTON L. PILLORI: (201) 796-7100
AFTER BUSINESS HOURS, HOLIDAYS:
(201) 796-7523
CHEMTREC ASSISTANCE: (800) 429-9300

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SUBSTANCE IDENTIFICATION

SUBSTANCE: EMMETHANOLXX

CAS-NUMBER 67-56-1

TRADE NAMES/SYNONYMS:

METHYL ALCOHOL; WOOD ALCOHOL; METHYL HYDROXIDE; CARBINOL;
MONOHYDROXYMETHANE; WOOD SPIRIT; WOOD NAPHTHA; METHYLOL; COLONIAL SPIRIT;
COLUMBIAN SPIRIT; PYROXYLIC SPIRIT; STCC 4909230; UN 1230; RCRA U154; CH4O;
A-454; A-452; A-936; A-408; A-947; A-935; A-412; A-411; A-433P; SW-2; SC-95;
ACC14280

CHEMICAL FAMILY:
HYDROXYL, ALIPHATIC

MOLECULAR FORMULA: C-H3-O-H

MOLECULAR WEIGHT: 32.04

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=3 REACTIVITY=0 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=1 FIRE=3 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: METHYL ALCOHOL (METHANOL)

PERCENT: 100

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

METHYL ALCOHOL (METHANOL):
200 PPM (260 MG/M3) OSHA TWA (SKIN); 250 PPM (310 MG/M3) OSHA STEL
200 PPM (260 MG/M3) ACGIH TWA (SKIN); 250 PPM (310 MG/M3) ACGIH STEL
200 PPM NIOSH RECOMMENDED 10 HOUR TWA;
800 PPM NIOSH RECOMMENDED 15 MINUTE CEILING

5000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS LIQUID WITH A CHARACTERISTIC ALCOHOLIC ODOR.

BOILING POINT: 149 F (65 C) MELTING POINT: -137 F (-94 C)

SPECIFIC GRAVITY: 0.7914 VAPOR PRESSURE: 97.25 MMHG @ 20 C

EVAPORATION RATE: (BUTYL ACETATE=1) 4.6 SOLUBILITY IN WATER: VERY SOLUBLE

ODOR THRESHOLD: 100 PPM VAPOR DENSITY: 1.11

SOLVENT SOLUBILITY: ETHER, BENZENE, ALCOHOL, ACETONE, CHLOROFORM, ETHANOL.

VISCOSITY: 0.59 CPS @ 20 C

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
DANGEROUS FIRE HAZARD WHEN EXPOSED TO HEAT, FLAME, OR OXIDIZERS.

VAPORS ARE HEAVIER THAN AIR AND MAY TRAVEL A CONSIDERABLE DISTANCE TO A SOURCE OF IGNITION AND FLASH BACK.

VAPOR-AIR MIXTURES ARE EXPLOSIVE.

FLASH POINT: 52 F (11 C) (CC) UPPER EXPLOSIVE LIMIT: 36.0%

LOWER EXPLOSIVE LIMIT: 6.0% AUTOIGNITION TEMP.: 725 F (385 C)

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FLAMMABILITY CLASS(OSHA): IS:

REFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY OR ALCOHOL FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR ALCOHOL FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
MOVE CONTAINER FROM FIRE AREA IF POSSIBLE. DIKE FIRE CONTROL WATER FOR LATER DISPOSAL; DO NOT SCATTER THE MATERIAL. COOL FIRE-EXPOSED CONTAINERS WITH WATER FROM SIDE UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM STORAGE TANK ENDS. WITHDRAW IMMEDIATELY IN CASE OF RISING SOUND FROM VENTING SAFETY DEVICE OR ANY DISCOLORATION OF STORAGE TANK DUE TO FIRE (1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4, GUIDE PAGE 28).

EXTINGUISH ONLY IF FLOW CAN BE STOPPED; USE WATER IN FLOODING AMOUNTS AS FOG. SOLID STREAMS MAY NOT BE EFFECTIVE. COOL CONTAINERS WITH FLOODING QUANTITIES OF WATER, APPLY FROM AS FAR A DISTANCE AS POSSIBLE. AVOID BREATHING TOXIC VAPORS, KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND 172.402:
FLAMMABLE LIQUID

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.119
EXCEPTIONS: 49CFR173.118

TOXICITY

METHYL ALCOHOL (METHANOL):
IRRITATION DATA: 20 MG/24 HOURS SKIN-RABBIT MODERATE; 40 MG EYE-RABBIT MODERATE; 100 MG/24 HOURS EYE-RABBIT MODERATE.
TOXICITY DATA: 86000 MG/M3 INHALATION-HUMAN TCLO; 300 PPM INHALATION-HUMAN TCLO; 64000 PPM/4 HOURS INHALATION-RAT LC50; 1000 PPM INHALATION-MONKEY LCLO; 50 GM/M3/2 HOURS INHALATION-MOUSE LCLO; 44000 MG/M3/6 HOURS INHALATION-CAT LCLO; 15800 MG/KG SKIN-RABBIT LD50; 393 MG/KG SKIN-MONKEY LDLO; 428 MG/KG ORAL-HUMAN LDLO; 143 MG/KG ORAL-HUMAN LDLO; 6422 UG/KG ORAL-MAN LDLO; 3429 MG/KG ORAL-MAN TDLO; 4 GM/KG ORAL-WOMAN TDLO; 7 GM/KG ORAL-MONKEY LD50; 5628 MG/KG ORAL-RAT LD50; 7300 MG/KG ORAL-MOUSE LD50; 14200 MG/KG ORAL-RABBIT LD50; 868 MG/KG UNREPORTED-MAN LDLO; 7529 MG/KG INTRAPERITONEAL-RAT LD50; 10765 MG/KG INTRAPERITONEAL-MOUSE LD50; 1826 MG/KG INTRAPERITONEAL-RABBIT LD50; 9800 MG/KG SUBCUTANEOUS-MOUSE LD50; 2131 MG/KG INTRAVENOUS-RAT LD50; 4710 MG/KG INTRAVENOUS-MOUSE LD50; 8907 MG/KG INTRAVENOUS-RABBIT LD50; MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS).
CARCINOGEN STATUS: NONE.
LOCAL EFFECTS: IRRITANT- SKIN, EYE.
ACUTE TOXICITY LEVEL: SLIGHTLY TOXIC BY INHALATION, DERMAL ABSORPTION, INGESTION.
TARGET EFFECTS: NEUROTOXIN; CENTRAL NERVOUS SYSTEM DEPRESSANT.
AT INCREASED RISK FROM EXPOSURE: PERSONS WITH CHRONIC RESPIRATORY, LIVER, KIDNEY, EYE, OR SKIN DISEASES.

HEALTH EFFECTS AND FIRST AID

INHALATION:

METHYL ALCOHOL (METHANOL):

NARCOTIC/NEUROTOXIN. 25,000 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

ACUTE EXPOSURE- INTOXICATION MAY RESULT IN A STATE OF INEBRIATION. WITHIN 12-18 HOURS, COUGHING, HEADACHE, TINNITUS, DULLNESS, ANOREXIA, WEAKNESS, VERTIGO, FATIGUE, RESTLESSNESS, INSOMNIA, AND LEG CRAMPS MAY OCCUR, FOLLOWED BY NAUSEA, VOMITING, COLIC, CONSTIPATION, VIOLENT PAIN IN THE BACK, ABDOMEN, AND EXTREMITIES, MUSCULAR INCOORDINATION, SWEATING, COLD, CLAMMY EXTREMITIES, DYSPNEA, AND OTHER SIGNS OF NARCOSIS, THEN TRACHEITIS, BRONCHITIS, AND BLEPHAROSPASM. APATHY OR DELIRIUM MAY PROGRESS TO COMA. EXCITEMENT, MANIA, AND CONVULSIONS RARELY OCCUR. BLURRED OR DIMMED VISION WITH OPTIC NEURITIS, NYSTAGMUS, DILATED, UNRESPONSIVE PUPILS, EYE PAIN, CONCENTRIC CONSTRICTION OF VISUAL FIELDS, PHOTOPHORIA, AND OPTIC NERVE ATROPHY, FOLLOWED BY TRANSIENT OR PERMANENT BLINDNESS MAY OCCUR. ACIDOSIS MAY RESULT IN RAPID AND SHALLOW RESPIRATION, CYANOSIS, COMA, AND HYPOTENSION. MILD TACHYCARDIA, CARDIAC DEPRESSION, AND PERIPHERAL NEURITIS ARE POSSIBLE, AS WELL AS LIVER AND KIDNEY DAMAGE, AND CEREBRAL AND PULMONARY EDEMA. DEATH IS POSSIBLE FROM RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. PROLONGED ASTHENIA AND PARTIAL OR COMPLETE LOSS OF VISION MAY BE DELAYED. IRREVERSIBLE CENTRAL NERVOUS SYSTEM EFFECTS INCLUDING MOTOR DYSFUNCTION WITH RIGIDITY, SPASTICITY, AND HYPOKINESIS HAVE BEEN REPORTED.

CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE MAY CAUSE SYMPTOMS SUCH AS VISUAL IMPAIRMENT, POSSIBLY BLINDNESS, AND OTHER EFFECTS AS IN ACUTE EXPOSURE. REPEATED EXPOSURE TO 200-375 PPM CAUSED RECURRENT HEADACHES IN WORKERS. EXPOSURE FOR 4 YEARS TO 1200-8000 PPM RESULTED IN MARKED

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DIMINUTION OF VISION AND ENLARGEMENT OF THE LIVER IN A WORKMAN. FETAL DEVELOPMENTAL ABNORMALITIES AND EFFECTS ON THE EMBRYO OR FETUS HAVE BEEN REPORTED FROM PROLONGED EXPOSURE TO METHYL ALCOHOL BY PREGNANT RATS.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, PERFORM ARTIFICIAL RESPIRATION. KEEP PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:

METHYL ALCOHOL (METHANOL):
IRRITANT/NARCOTIC/NEUROTOXIN.

ACUTE EXPOSURE- CONTACT WITH LIQUID MAY CAUSE IRRITATION. IT MAY BE ABSORBED THROUGH THE SKIN TO CAUSE SYSTEMIC EFFECTS INCLUDING CENTRAL NERVOUS SYSTEM DEPRESSION, NARCOSIS, OPTIC NEURITIS, AND ACIDOSIS. LETHAL AMOUNTS MAY BE ABSORBED THROUGH INTACT SKIN.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT WITH THE LIQUID MAY CAUSE DEFATTING OF THE SKIN RESULTING IN ERYTHEMA, SCALING, AND ECZEMATOID DERMATITIS. CHRONIC ABSORPTION MAY RESULT IN VISUAL IMPAIRMENT AND OPTIC NEURITIS AND OTHER EFFECTS AS IN ACUTE EXPOSURE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:

METHYL ALCOHOL (METHANOL):
IRRITANT.

ACUTE EXPOSURE- DIRECT CONTACT WITH THE DILUTED SOLUTIONS MAY CAUSE MILD IRRITATION AND THE UNDILUTED LIQUID MAY CAUSE MODERATE CORNEAL OPACITY AND CONJUNCTIVAL REDNESS IN RABBITS. APPLICATION OF A DROP OF METHANOL IN RABBITS' EYES CAUSED A MILD REVERSIBLE REACTION, GRADED 3 ON A SCALE OF 1-10 AFTER 24 HOURS. INGESTION, INHALATION, OR SKIN ABSORPTION MAY RESULT IN BLURRED OR DIMMED VISION WITH OPTIC NEURITIS, EYE PAIN, ATROPHY, CONCENTRIC VISUAL FIELDS, AND PHOTOPHOBIA, FOLLOWED BY TRANSIENT OR PERMANENT, COMPLETE OR BILATERAL BLINDNESS.

CHRONIC EXPOSURE- REPEATED OR PROLONGED CONTACT MAY CAUSE CONJUNCTIVITIS. VISUAL IMPAIRMENT AS DESCRIBED ABOVE MAY INDICATE CHRONIC EXPOSURE BY INGESTION, INHALATION OR SKIN ABSORPTION.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE. OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:

METHYL ALCOHOL (METHANOL):
NARCOTIC/NEUROTOXIN.

ACUTE EXPOSURE- SYMPTOMS MAY BE DELAYED 12-18 HOURS AND MAY INCLUDE COUGHING, HEADACHE, DULLNESS, VERTIGO, ANOREXIA, WEAKNESS, FATIGUE, RESTLESSNESS, INSOMNIA, AND LEG CRAMPS, FOLLOWED BY NAUSEA, OCCASIONAL VOMITING AND DIARRHEA, VIOLENT PAIN IN THE BACK, ABDOMEN, AND EXTREMITIES. MUSCULAR INCOORDINATION, SWEATING, COLD AND CLAMMY EXTREMITIES, DYSPNEA, AND OTHER SIGNS OF NARCOSIS MAY OCCUR. APATHY OR DELIRIUM MAY PROGRESS TO COMA, EXCITEMENT, MANIA, AND CONVULSIONS HAVE OCCURRED RARELY. BLURRED OR DIMMED VISION WITH OPTIC NEURITIS, DILATED, UNRESPONSIVE PUPILS, EYE PAIN, CONCENTRIC CONSTRICTION OF VISUAL FIELDS, PHOTOPHOBIA, AND OPTIC NERVE ATROPHY, FOLLOWED BY TRANSIENT OR PERMANENT BLINDNESS MAY OCCUR. ACIDOSIS MAY RESULT IN RAPID, SHALLOW RESPIRATION, CYANOSIS, COMA, AND HYPOTENSION. MILD TACHYCARDIA, CARDIAC DEPRESSION, AND PERIPHERAL NEURITIS ARE POSSIBLE, AS WELL AS LIVER AND KIDNEY DAMAGE, AND CEREBRAL AND PULMONARY EDEMA. DEATH IS POSSIBLE FROM RESPIRATORY FAILURE OR CIRCULATORY COLLAPSE. THE USUAL FATAL DOSE IS 100-250 ML. PROLONGED ASTHENIA AND PARTIAL OR COMPLETE LOSS OF VISION MAY BE DELAYED. IRREVERSIBLE CENTRAL NERVOUS SYSTEM EFFECTS INCLUDING MOTOR DYSFUNCTION WITH RIGIDITY, SPASTICITY, AND HYPOKINESIS HAVE BEEN REPORTED.

CHRONIC EXPOSURE- REPEATED OR PROLONGED INGESTION MAY CAUSE VISUAL IMPAIRMENT AND POSSIBLY, BLINDNESS. LIVER, KIDNEY, AND BRAIN DAMAGE MAY OCCUR. EFFECTS ON THE NEWBORN HAVE BEEN REPORTED FOLLOWING PROLONGED EXPOSURE TO METHYL ALCOHOL BY PREGNANT RATS.

FIRST AID- IF INGESTION OF METHANOL IS DISCOVERED WITHIN 2 HOURS, GIVE SYRUP OF IPECAC. LAVAGE THOROUGHLY WITH 2-4 L OF TAP WATER WITH SODIUM BICARBONATE (20 G/L) ADDED. GET MEDICAL ATTENTION IMMEDIATELY. LAVAGE SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL. (DREISBACH, HANDBOOK OF POISONING, 11TH ED.).

ANTIDOTE:

THE FOLLOWING ANTIDOTE(S) HAVE BEEN RECOMMENDED. HOWEVER, THE DECISION AS TO WHETHER THE SEVERITY OF POISONING REQUIRES ADMINISTRATION OF ANY ANTIDOTE AND ACTUAL DOSE REQUIRED SHOULD BE MADE BY QUALIFIED MEDICAL PERSONNEL.

METHANOL POISONING:

GIVE ETHANOL, 50% (100 PROOF), 1.5 ML/KG ORALLY INITIALLY, DILUTED TO NOT MORE THAN 5% SOLUTION, FOLLOWED BY 0.5-1.0 ML/KG EVERY 2 HOURS ORALLY OR INTRAVENOUSLY FOR 4 DAYS IN ORDER TO REDUCE METABOLISM OF METHANOL AND TO ALLOW TIME FOR ITS EXCRETION. BLOOD ETHANOL LEVEL SHOULD BE IN THE RANGE OF 1-1.5 MG/ML (DREISBACH, HANDBOOK OF POISONING, 11TH ED.) ANTIDOTE SHOULD BE ADMINISTERED BY QUALIFIED MEDICAL PERSONNEL.

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ORAL OR INTRAVENOUS ADMINISTRATION OF 4-METHYLPYRAZOLE INHIBITS ALCOHOL DEHYDROGENASE AND HAS BEEN USED EFFECTIVELY AS AN ANTIDOTE FOR METHANOL OR ETHYLENE GLYCOL POISONING.

REACTIVITY

REACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

METHYL ALCOHOL (METHANOL);
ACETYL BROMIDE; VIOLENT REACTION WITH FORMATION OF HYDROGEN BROMIDE.
ALKYLALUMINUM SOLUTIONS; VIOLENT REACTION.
ALUMINUM; EXPLOSION HAZARD.
BARIUM PERCHLORATE; DISTILLATION YIELDS HIGHLY EXPLOSIVE ALKYL PERCHLORATE.
BERYLLIUM HYDRIDE; VIOLENT REACTION, EVEN AT -196 C.
BROMINE; VIGOROUSLY EXOTHERMIC REACTION.
CALCIUM CARBIDE; VIOLENT REACTION.
CHLORINE; POSSIBLE IGNITION AND EXPLOSION HAZARD.
CHLOROFORM AND SODIUM HYDROXIDE; EXPLOSIVE REACTION.
CHROMIUM TRIOXIDE (CHROMIC ANHYDRIDE); POSSIBLE IGNITION.
CYANURIC CHLORIDE; VIOLENT REACTION.
DICHLOROMETHANE; POSSIBLE IGNITION AND EXPLOSION.
DIETHYL ZINC; POSSIBLE IGNITION AND EXPLOSION.
HYDROGEN PEROXIDE + WATER; EXPLOSION HAZARD.
IODINE + ETHANOL + MERCURIC OXIDE; EXPLOSION HAZARD.
LEAD; CORRODES.
LEAD PERCHLORATE; EXPLOSION HAZARD.
MAGNESIUM; VIOLENT REACTION.
MAGNESIUM (POWDERED); MIXTURES ARE CAPABLE OF DETONATION.
NICKEL; POSSIBLE IGNITION IN THE PRESENCE OF NICKEL CATALYST.
NITRIC ACID (CONCENTRATED); MIXTURES OF GREATER THAN 25% ACID MAY DECOMPOSE VIOLENTLY.
OXIDIZERS (STRONG); FIRE AND EXPLOSION HAZARD.
PERCHLORIC ACID; EXPLOSION HAZARD.
PHOSPHOROUS TRIOXIDE; POSSIBLE VIOLENT REACTION AND IGNITION.
POTASSIUM; POSSIBLE DANGEROUS REACTION.
POTASSIUM HYDROXIDE + CHLOROFORM; EXOTHERMIC REACTION.
POTASSIUM TERT-BUTOXIDE; FIRE AND EXPLOSION HAZARD.
SODIUM + CHLOROFORM; POSSIBLE EXPLOSION.
SODIUM HYPOCHLORITE; EXPLOSION HAZARD.
SODIUM METHOXIDE + CHLOROFORM; POSSIBLE EXPLOSION.
SULFURIC ACID; FIRE AND EXPLOSION HAZARD.
ZINC; EXPLOSION HAZARD.

DECOMPOSITION:
THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC OXIDES OF CARBON.

POLYMERIZATION:
HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

****STORAGE****

STORE IN ACCORDANCE WITH 29 CFR 1910.106.

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

****DISPOSAL****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262, EPA HAZARDOUS WASTE NUMBER U154.

CONDITIONS TO AVOID

MAY BE IGNITED BY HEAT, SPARKS OR FLAMES. CONTAINER MAY EXPLODE IN HEAT OF FIRE. VAPOR EXPLOSION AND POISON HAZARD INDOORS, OUTDOORS OR IN SEWERS. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

SPILL AND LEAK PROCEDURES

SOIL SPILL:
DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

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TR SPILL:
APPLY WATER SPRAY TO KNOCK DOWN VAPORS.

WATER SPILL:
ALLOW SPILLED MATERIAL TO AERATE.

LIMIT SPILL MOTION AND DISPERSION WITH NATURAL BARRIERS OR OIL SPILL CONTROL BOOMS.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

OCCUPATIONAL SPILL:
SHUT OFF IGNITION SOURCES. DO NOT TOUCH SPILLED MATERIAL. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. FOR SMALL SPILLS, TAKE UP WITH SAND OR OTHER ABSORBENT MATERIAL AND PLACE INTO CONTAINERS FOR LATER DISPOSAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY.

REPORTABLE QUANTITY (RQ): 5000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D. C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET THE PUBLISHED EXPOSURE LIMITS. VENTILATION EQUIPMENT MUST BE EXPLOSION-PROOF.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U. S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS OR NIOSH CRITERIA DOCUMENTS; OR DEPARTMENT OF LABOR, 29CFR1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE OF OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION.

METHYL ALCOHOL (METHANOL):

2000 PPM- ANY SUPPLIED-AIR RESPIRATOR.
ANY SELF-CONTAINED BREATHING APPARATUS.

5000 PPM- ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

10,000 PPM- ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A TIGHT-FITTING FACEPIECE
OPERATED IN A CONTINUOUS FLOW MODE.

25,000 PPM- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED
IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY
SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES TO PREVENT EYE CONTACT WITH THIS SUBSTANCE. CONTACT LENSES SHOULD NOT BE WORN.

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-ADDITIONAL INFORMATION-

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REFIGHTING MEDIA:
DRY CHEMICAL, CARBON DIOXIDE OR HALON
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR STANDARD FOAM
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
STAY AWAY FROM STORAGE TANK ENDS. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER
FROM SIDE UNTIL WELL AFTER FIRE IS OUT (1987 EMERGENCY RESPONSE GUIDEBOOK,
DOT P 5800.4, GUIDE PAGE 74).

EXTINGUISH USING AGENTS SUITABLE FOR SURROUNDING FIRE. USE FLOODING QUANTITIES
OF WATER TO COOL AFFECTED CONTAINERS, APPLYING FROM AS FAR A DISTANCE AS
POSSIBLE. AVOID BREATHING HAZARDOUS VAPORS, KEEP UNWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
ORM-A

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND SUBPART E:
NONE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.605
EXCEPTIONS: 49CFR173.505

TOXICITY

DICHLOROMETHANE (METHYLENE CHLORIDE):
IRRITATION DATA: 162 MG EYE-RABBIT MODERATE; 10 MG EYE-RABBIT MILD;
500 MG/24 HOURS EYE-RABBIT MILD; 810 MG/24 HOURS SKIN-RABBIT SEVERE;
100 MG/24 HOURS SKIN-RABBIT MODERATE.
TOXICITY DATA: 500 PPM/1 YEAR-INTERMITTENT INHALATION-HUMAN TCLO;
500 PPM/8 HOURS INHALATION-HUMAN TCLO; 88000 MG/M3/30 MINUTES
INHALATION-RAT LC50; 14400 PPM/7 HOURS INHALATION-MOUSE LC50;
10000 PPM/7 HOURS INHALATION-RABBIT LCLO; 5000 PPM/2 HOURS INHALATION-GUINEA
PIG LCLO; 14108 PPM/7 HOURS INHALATION-DOG LCLO;
43400 MG/M3/4.5 HOURS INHALATION-CAT LCLO; 357 MG/KG ORAL-HUMAN LDLO; 1600
MG/KG ORAL-RAT LD50; 1900 MG/KG ORAL-RABBIT LDLO; 3 GM/KG ORAL-DOG LDLO;
6460 MG/KG SUBCUTANEOUS-MOUSE LD50; 2700 MG/KG SUBCUTANEOUS-RABBIT LDLO;
2700 MG/KG SUBCUTANEOUS-DOG LDLO; 200 MG/KG INTRAVENOUS-DOG LDLO;
916 MG/KG INTRAPERITONEAL-RAT LD50; 950 MG/KG INTRAPERITONEAL-DOG LDLO;
437 MG/KG INTRAPERITONEAL-MOUSE LD50; 4770 MG/KG UNREPORTED-MOUSE LD50;
MUTAGENIC DATA (RTECS); REPRODUCTIVE EFFECTS DATA (RTECS);
TUMORIGENIC DATA (RTECS).
CARCINOGEN STATUS: HUMAN INADEQUATE EVIDENCE, ANIMAL SUFFICIENT EVIDENCE (IARC
CLASS-2B). EXPOSURE BY INHALATION INCREASED THE INCIDENCE OF BENIGN
AND MALIGNANT LUNG AND LIVER TUMORS IN MICE OF EACH SEX AND THE INCIDENCE OR
MULTIPLICITY OF BENIGN MAMMARY TUMORS IN RATS OF EACH SEX; IN MALE RATS, AN
INCREASED INCIDENCE OF SARCOMAS LOCATED IN THE NECK WAS ALSO OBSERVED.
LOCAL EFFECTS: IRRITANT- INHALATION, SKIN, EYE.
ACUTE TOXICITY LEVEL: MODERATELY TOXIC BY INHALATION AND INGESTION.
TARGET EFFECTS: CENTRAL NERVOUS SYSTEM DEPRESSANT; CHEMICAL ASPHYXANT.
POISONING MAY AFFECT THE BLOOD, LIVER AND KIDNEYS.
AT INCREASED RISK FROM EXPOSURE; PERSONS WITH SKIN, LIVER, KIDNEY,
CARDIOVASCULAR DISEASE OR ANEMIA.
ADDITIONAL DATA: CONCURRENT EXPOSURE TO OTHER SOURCES OF CARBON MONOXIDE,
SMOKING, OR PHYSICAL ACTIVITY MAY INCREASE THE LEVEL OF CARBOXYHEMOGLOBIN
IN THE BLOOD RESULTING IN ADDITIVE EFFECTS. ALCOHOLIC BEVERAGES MAY ENHANCE
THE TOXIC EFFECTS. STIMULANTS SUCH AS EPINEPHRINE MAY INDUCE CARDIAC
ARRHYTHMIAS. ONE STUDY INDICATED THAT CHRONIC EXPOSURE MAY BE ASSOCIATED
WITH AN INCREASED RISK OF SPONTANEOUS ABORTION. DICHLOROMETHANE CROSSES
THE PLACENTAL BARRIER AND IS EXCRETED IN HUMAN MILK.

HEALTH EFFECTS AND FIRST AID

INHALATION:
DICHLOROMETHANE (METHYLENE CHLORIDE):
IRRITANT/NARCOTIC/CHEMICAL ASPHYXANT/CARCINOGEN.
ACUTE EXPOSURE- HUMAN EXPOSURE TO 100 PPM HAS RESULTED IN UPPER RESPIRATORY
TRACT IRRITATION; CONCENTRATIONS AS LOW AS 200 PPM HAVE PRODUCED TEMPORARY
NEUROBEHAVIOURAL EFFECTS; 500-1000 PPM FOR 1-2 HOURS HAS CAUSED
LIGHTHEADEDNESS AND ELEVATED CARBOXYHEMOGLOBIN LEVEL; 2300 PPM FOR 30
MINUTES HAS CAUSED NAUSEA AND NARCOSIS; 5000 PPM HAS CAUSED HEADACHE,
FATIGUE, NEURASTHENIC DISORDERS AND DIGESTIVE DISTURBANCES. OTHER
SYMPTOMS MAY INCLUDE DIZZINESS, TINGLING, NUMBNESS OF THE EXTREMITIES,
A SENSATION OF HEAT, A SENSATION OF FULLNESS IN THE HEAD, DRUNKENNESS,
STUPOR, DULLNESS AND MENTAL CONFUSION. MASSIVE EXPOSURE MAY CAUSE
PHARYNGEAL EROSION, PULMONARY EDEMA, STAGGERING, HEMOLYSIS WITH
GROSS HEMATURIA, RAPID UNCONSCIOUSNESS AND DEATH. RECOVERY IS GENERALLY
COMPLETE IF EXPOSURE IS TERMINATED BEFORE ANESTHETIC DEATH. EXPOSURE TO
HIGH LEVELS MAY ALSO CAUSE CARDIAC ARRHYTHMIAS.
CHRONIC EXPOSURE- MORE THAN 100 WORKERS EXPOSED TO LEVELS BELOW 500 PPM HAVE
DEVELOPED HEALTH PROBLEMS INCLUDING SIGNIFICANT UPPER RESPIRATORY
IRRITATION, EXACERBATION OF CORONARY ARTERY DISEASE, AND A HIGH INCIDENCE

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OF NEUROTOXICITY. INCREASED COMPLAINTS OF CHEST PAINS WERE REPORTED AT CONCENTRATIONS OF 10 TO 25 PPM. REPEATED HUMAN EXPOSURE TO 500-3500 PPM HAS CAUSED SIGNS OF TOXIC ENCEPHALOPATHY WITH ACOUSTICAL AND OPTICAL DELUSIONS AND HALLUCINATIONS. A CASE OF SERIOUS CEREBRAL DETERIORATION WAS OBSERVED IN AN INDIVIDUAL EXPOSED FOR SEVERAL YEARS TO DICHLOROMETHANE. IN A MORTALITY STUDY OF TWO GROUPS OF WORKERS, ONE EXPOSED TO ACETONE AND THE OTHER TO DICHLOROMETHANE AND ACETONE, A STATISTICALLY SIGNIFICANT DIFFERENCE IN DEATHS FROM DISEASES OF THE CIRCULATORY SYSTEM AND FROM ISCHEMIC HEART DISEASE WERE REPORTED FROM THE DICHLOROMETHANE AND ACETONE GROUP. IN ANOTHER MORTALITY STUDY OF WORKERS EXPOSED TO DICHLOROMETHANE, A SIGNIFICANT INCREASE IN HYPERTENSIVE DISEASE AND A "SUGGESTIVE EXCESS" OF PANCREATIC CANCER WERE REPORTED. LIVER DISEASE HAS BEEN REPORTED IN WORKERS. IN ONE STUDY, AN INCREASE IN SERUM BILIRUBIN WAS OBSERVED IN EXPOSED WORKERS, BUT NO OTHER SIGN OF LIVER INJURY OR HEMOLYSIS WAS REPORTED. ADVERSE LIVER EFFECTS WERE OBSERVED IN SEVERAL ANIMAL SPECIES CHEMICALLY EXPOSED. TESTICULAR ATROPHY WAS REPORTED IN MICE EXPOSED TO 4000 PPM OVER 2 YEARS. REPEATED INHALATION BY RODENTS PRIOR TO AND/OR DURING GESTATION CAUSED FETAL SKELETAL ABNORMALITIES AND BEHAVIORAL EFFECTS IN NEWBORN OFFSPRING. REPEATED INHALATION INCREASED THE INCIDENCE OF BENIGN AND MALIGNANT LUNG AND LIVER TUMORS IN MICE OF EACH SEX AND THE INCIDENCE OR MULTIPLICITY OF BENIGN MAMMARY TUMORS IN RATS OF EACH SEX. IN MALE RATS, AN INCREASED INCIDENCE OF SARCOMAS LOCATED IN THE NECK WAS ALSO OBSERVED.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

SKIN CONTACT:
DICHLOROMETHANE (METHYLENE CHLORIDE):
IRRITANT.

ACUTE EXPOSURE- MAY CAUSE EFFECTS RANGING FROM MILD IRRITATION TO SEVERE PAIN, PARESTHESIAS, AND POSSIBLY BURNS, DEPENDING ON THE INTENSITY OF CONTACT.

CHRONIC EXPOSURE- PROLONGED OR REPEATED CONTACT MAY CAUSE A DRY, SCALY AND FISSURED DERMATITIS DUE TO DEFATTING ACTION OF LIQUID ON SKIN.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
DICHLOROMETHANE (METHYLENE CHLORIDE):
IRRITANT.

ACUTE EXPOSURE- VAPOR CONCENTRATIONS ABOVE 2000 PPM MAY CAUSE IRRITATION. DIRECT CONTACT MAY CAUSE PAIN AND EXTREME IRRITATION, BUT IT IS NOT LIKELY TO CAUSE SERIOUS INJURY. 10 MG APPLIED TO RABBIT EYES PRODUCED KERATITIS, IRITIS, INCREASED CORNEAL THICKNESS, AND INFLAMMATION OF THE CONJUNCTIVA AND EYELIDS WITH SOME EFFECTS LASTING UP TO TWO WEEKS. CHRONIC EXPOSURE- REPEATED OR PROLONGED EXPOSURE TO IRRITANTS MAY CAUSE CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER OR NORMAL SALINE, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (APPROXIMATELY 15-20 MINUTES). GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
DICHLOROMETHANE (METHYLENE CHLORIDE):
NARCOTIC/CHEMICAL ASPHYXANT.

ACUTE EXPOSURE- MAY CAUSE RAPID, THEN SLOWED RESPIRATION, GLOTTAL AND PHARYNGEAL EDEMA, INTRAVASCULAR HEMOLYSIS WITH GROSS HEMATURIA, GASTROINTESTINAL ULCERATION AND HEMORRHAGE, AND CARBOXYHEMOGLOBINEMIA. THESE SYMPTOMS MAY PROGRESS RAPIDLY TO UNCONSCIOUSNESS AND LACK OF RESPONSE TO PAINFUL STIMULI. PHARYNGEAL EROSIONS MAY DISTURB THE SWALLOWING MECHANISM RESULTING IN ASPIRATION PNEUMONIA. IN ADDITION, SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION MAY OCCUR FOLLOWED BY CONVULSIONS AND PARESTHESIA OF THE EXTREMITIES. LARGE DOSES MAY CAUSE LIVER AND KIDNEY DAMAGE. THE ESTIMATED LETHAL DOSE FOR AN ADULT IS 25 GRAMS.

CHRONIC EXPOSURE- REPEATED INGESTION BY RATS AND MICE RESULTED IN HISTOMORPHOLOGICAL CHANGES IN THE LIVER.

FIRST AID- REMOVE BY GASTRIC LAVAGE OR EMESIS. MAINTAIN BLOOD PRESSURE AND AIRWAY. GIVE OXYGEN IF RESPIRATION IS DEPRESSED. DO NOT PERFORM GASTRIC LAVAGE OR EMESIS IF VICTIM IS UNCONSCIOUS. GET MEDICAL ATTENTION IMMEDIATELY (DREISBACH, HANDBOOK OF POISONING, 11TH ED.). ADMINISTRATION OF GASTRIC LAVAGE OR OXYGEN SHOULD BE PERFORMED BY QUALIFIED MEDICAL PERSONNEL.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

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ACTIVITY:
STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

INCOMPATIBILITIES:

DICHLOROMETHANE (METHYLENE CHLORIDE):
ALKALI METALS: POSSIBLE EXPLOSIVE REACTION.
ALUMINUM: VIOLENT, UNCONTROLLABLE REACTION ABOVE 95 C.
CAUSTICS (STRONG): VIGOROUS, POSSIBLY VIOLENT REACTION.
COPPER: MAY CORRODE AT ELEVATED TEMPERATURES IN THE PRESENCE OF MOISTURE.
DINITROGEN PENTOXIDE: POSSIBLE EXPLOSION.
DINITROGEN TETROXIDE: FORMS SHOCK-SENSITIVE MIXTURE.
IRON: MAY CORRODE AT ELEVATED TEMPERATURES IN THE PRESENCE OF MOISTURE.
LITHIUM: FORMS SHOCK-SENSITIVE MIXTURE.
MAGNESIUM: POSSIBLE EXPLOSION.
NICKEL: MAY CORRODE AT ELEVATED TEMPERATURES IN THE PRESENCE OF MOISTURE.
NITRIC ACID: EXOTHERMIC REACTION YIELDING DETONABLE SOLUTION.
OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.
OXYGEN (LIQUID): EXPLOSIVE REACTION ON IGNITION.
PLASTICS, RUBBER, AND COATINGS: MAY BE ATTACKED.
POTASSIUM: EXPLOSIVE REACTION.
POTASSIUM HYDROXIDE + N-METHYL-N-NITROSO UREA: POSSIBLE EXPLOSION.
POTASSIUM TERT-BUTOXIDE: IGNITION REACTION.
SODIUM: FORMS SHOCK-SENSITIVE MIXTURE.
SODIUM-POTASSIUM ALLOY: FORMS SHOCK-SENSITIVE MIXTURE.
STAINLESS STEEL: MAY CORRODE AT ELEVATED TEMPERATURES IN THE PRESENCE OF MOISTURE.
TITANIUM: POSSIBLE VIOLENT REACTION.
ZINC: POSSIBLE VIOLENT REACTION.

DECOMPOSITION:

THERMAL DECOMPOSITION PRODUCTS MAY INCLUDE TOXIC AND HAZARDOUS PHOSGENE GAS, TOXIC AND CORROSIVE FUMES OF CHLORIDES, AND OXIDES OF CARBON.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

*****STORAGE*****

PROTECT AGAINST PHYSICAL DAMAGE. STORE IN COOL, DRY, WELL VENTILATED LOCATION, AWAY FROM ANY AREA WHERE THE FIRE HAZARD MAY BE ACUTE (NFPA 79, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

*****DISPOSAL*****

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40CFR 262. EPA HAZARDOUS WASTE NUMBER U080.

CONDITIONS TO AVOID

MAY BURN BUT DOES NOT IGNITE READILY. CONTAINER MAY EXPLODE IN HEAT OF FIRE.

SPILL AND LEAK PROCEDURES

SOIL SPILL:

DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

AIR SPILL:

APPLY WATER SPRAY TO KNOCK DOWN VAPORS.

WATER SPILL:

TRAP SPILLED MATERIAL AT BOTTOM IN DEEP WATER POCKETS, EXCAVATED HOLDING AREAS OR WITHIN SAND BAG BARRIERS.

USE SUCTION HOSES TO REMOVE TRAPPED SPILL MATERIAL.

THE CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (PROPOSITION 65) PROHIBITS CONTAMINATING ANY KNOWN SOURCE OF DRINKING WATER WITH SUBSTANCES KNOWN TO CAUSE CANCER AND/OR REPRODUCTIVE TOXICITY.

OCCUPATIONAL SPILL:

SHUT OFF IGNITION SOURCES. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. FOR SMALL LIQUID SPILLS, TAKE UP WITH SAND, EARTH OR OTHER ABSORBENT MATERIAL. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. NO SMOKING, FLAMES

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OR FLARES IN HAZARD AREA! KEEP UNNECESSARY PEOPLE AWAY.

REPORTABLE QUANTITY (RQ): 1000 POUNDS
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:
PROVIDE LOCAL EXHAUST VENTILATION AND/OR GENERAL DILUTION VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS, NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29CFR1910 SUBPART Z.
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

FOR DICHLOROMETHANE (METHYLENE CHLORIDE):
AT ANY DETECTABLE CONCENTRATION:

ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.
ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH ORGANIC VAPOR CANISTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT TO PREVENT REPEATED OR PROLONGED SKIN CONTACT WITH THIS SUBSTANCE.

GLOVES:
EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:
EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:
WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED - FISHER SCIENTIFIC, INC.
CREATION DATE: 09/26/84 REVISION DATE: 10/13/89

-ADDITIONAL INFORMATION-

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New Haven, CT 06511
MATERIAL SAFETY DATA SHEET

CORPORATE RESEARCH & DEVELOPMENT

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Compliments of AccuStandard, Inc.

NO. 310

METHYLENE CHLORIDE

REVISION C

Date September 1978

MS
 MATERIALS
 SERVICES
 INFORMATION

SECTION I. MATERIAL IDENTIFICATION

MATERIAL NAME: [REDACTED]

OTHER DESIGNATIONS: Dichloromethane, Methane Dichloride, CH₂Cl₂, GE Material D5B89, ASTM D3506, CAS# 000 075 092

MANUFACTURER: Available from many suppliers, including Dow Chemical Co. and Diamond Shamrock Corp., Electrochemicals

SECTION II. INGREDIENTS AND HAZARDS

Methylene Chloride

*ACGIH (1978) Intended changes list has dropped TLV from 200 ppm to 100 ppm. Current OSHA TLV remains at 500 ppm. NIOSH has proposed a 75 ppm 10 hr-TWA with a ceiling concentration of 500 ppm. (15 minute sampling period) NIOSH also warns that toxic hazards with CH₂Cl₂ are increased by the presence of alcohol and/or carbon monoxide and by heavy labor and smoking.

Ca 100

HAZARD DATA

8-hr TWA 100 ppm*

Human, inhalation
 TCl₀ 500 ppm/8-hr
 (blood effects)

Rat, oral LD₅₀
 2136 mg/kg

SECTION III. PHYSICAL DATA

Boiling point, 1 atm deg F (C) -----	104 (40)	Specific gravity, 25/25C ---	1.32
Vapor pressure at 20 C, mm Hg -----	340	Volatiles, % -----	ca 100
Vapor density (Air=1) -----	2.9	Evaporation rate (CCl ₄ =1) ---	1.47
Water solubility, wt. % at 20 C -----	1.6	Solidifies, deg C -----	-95

Appearance & Odor: Colorless liquid; ether-like, sweetish odor. The recognition threshold (unfatigued) is 214 ppm, 100% of test panel.

SECTION IV. FIRE AND EXPLOSION DATA

			LOWER	UPPER
Flash Point and Method	Autoignition Temp.	Flammability Limits In Air		
None	>1033 F	Vol. % at >100 C	12	—

This material does not give a flash or fire point by the conventional test methods. It does form weakly combustible mixtures at high temperatures and high concentrations in air; and it can burn or explode in oxygen enriched air.

Firefighters should use self-contained breathing apparatus (with eye protection) for protection from suffocating and intoxicating vapors and from high temperature decomposition products.

SECTION V. REACTIVITY DATA

Methylene chloride is a stable compound under normal conditions of storage and use; however, exposure to high temperatures (open flames, welding arcs, etc.) can give corrosive and toxic thermal-oxidative decomposition products such as hydrogen chloride and phosgene. It does not undergo hazardous polymerization. Prolonged exposure to excess water may cause noticeable hydrolysis above 60 C. Prevent contact with alkali metals and finely powdered aluminum and magnesium to avoid possible violent reactions.

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SECTION VI. HEALTH HAZARD INFORMATION

TLV 100 ppm (360 mg/m³) (See Sect II)

CGIH TLV for methylene chloride lowered from 200 ppm (1977); NIOSH has proposed a 10-hr TWA of 75 ppm. Present OSHA value of 500 ppm will probably be lowered.

Inhalation of high concentrations causes loss of coordination and equilibrium, and, if exposure is prolonged excessively, unconsciousness and even death. Prolonged skin contact can be irritating; absorbed through the skin. Eye contact is painful and irritating, but it is not believed likely to produce serious effects. Methylene chloride metabolizes to produce carbon monoxide in the body; it increases blood carboxyhemoglobin levels in the blood, reducing the oxygen-carrying capacity of the blood.

FIRST AID:

Eye and Skin contact: Flush contact area with plenty of running water. If irritation persists, get medical attention.

Inhalation: Remove to fresh air; give artificial respiration, if required. Keep quiet and warm. Get medical attention; advise physician not to use adrenalin.

Ingestion: Get prompt medical attention. (If physician unavailable, give water or milk and induce vomiting.) Advise physician not to use adrenalin.

SECTION VII. SPILL, LEAK, AND DISPOSAL PROCEDURES

For small spills, soak up with an absorbent solid, such as vermiculite, avoiding breathing of vapors and using gloves to avoid contact. Evaporate off solvent in an exhaust hood or bury with absorbent in a landfill.

When large spills occur, evacuate area; notify safety personnel; provide ventilation. Use protective equipment during clean-up, such as self-contained breathing apparatus, boots, gloves, etc. Contain and recover liquid when possible. Pick up residue with absorbent (as with small spills) or flush to ground (not to sewer) to evaporate.

Reclaim waste solvent by filtration and distillation procedures or dispose of via a licensed, waste solvent disposal company.

SECTION VIII. SPECIAL PROTECTION INFORMATION

Use general ventilation and efficient exhaust ventilation to meet TLV requirements. Air supplied or self-contained breathing apparatus should be available for emergency use. A full facepiece is required above 750 ppm.

Use neoprene or Viton gloves for skin protection and safety glasses. Chemical goggles or a face shield should be used where splashing is possible. An eye wash station should be readily available if splashing is probable.

NOTE: NIOSH indicates that carbon monoxide content and CH₂Cl₂ content of workplace air are additive and that both must be monitored where methylene chloride exposures occur. The 10-hr TWA for CO must not exceed about 9 ppm where exposure to methylene chloride occurs unless CH₂Cl₂ exposure is also controlled to a lower level than the TLV.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

Use caution in handling this material. Avoid airborne concentration build-up. Avoid exposure to high temperature. No smoking where vapors of this material are present. Store in a cool, well-ventilated area away from sources of heat. Open containers with caution.

When methylene chloride vapors are drawn into the combustion chamber of a space heater, severe corrosion damage to the heater can occur, even at levels well below TLV.

Those with a history of cardiovascular disease or who are heavy drinkers or smokers should avoid exposure to methylene chloride.

DATA SOURCE(S) CODE: 1-7, 9, 12, 16, 19, 21

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APPROVALS: HIS, CRD

Industrial Hygiene and Safety

Corporate Medical Staff

J. L. [Signature]
[Signature]
George F. Martlet

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METHYLENE CHLORIDE

MATERIAL SAFETY DATA SHEET

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SUBSTANCE IDENTIFICATION

CAS-NUMBER 75-09-2

SUBSTANCE: **METHYLENE CHLORIDE**

TRADE NAMES/SYNONYMS:

METHANE, DICHLORO-, METHYLENE CHLORIDE, METHYLENE DICHLORIDE,
METHANE DICHLORIDE, SOLAESTHIN, NARKOTIL, SOLMETHINE, RCRA U080,
STCC 4941132, UN 1593, D150, D151, D143, D142, D123, D35, D37, D37S, D378K,
BP1186, CH2CL2, ACC14930

CHEMICAL FAMILY:

HALOGEN COMPOUND, ALIPHATIC

MOLECULAR FORMULA: C-H2-CL2

MOLECULAR WEIGHT: 84.93

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=1
NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=1 REACTIVITY=0

COMPONENTS AND CONTAMINANTS

COMPONENT: METHYLENE CHLORIDE

PERCENT: 100.0

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

DICHLOROMETHANE (METHYLENE CHLORIDE):

500 PPM OSHA TWA; 1000 PPM OSHA CEILING; 2000 PPM/5 MIN IN 2 HOURS OSHA PEAK

50 PPM (174 MG/M3) ACGIH TWA

ACGIH A2- SUSPECTED HUMAN CARCINOGEN.

LOWEST FEASIBLE LIMIT NIOSH RECOMMENDED EXPOSURE CRITERIA

1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

SUBJECT TO CALIFORNIA PROPOSITION 65 CANCER AND/OR REPRODUCTIVE TOXICITY

WARNING AND RELEASE REQUIREMENTS- (APRIL 1, 1988)

PHYSICAL DATA

DESCRIPTION: CLEAR, COLORLESS LIQUID WITH AN MILD, CHLOROFORM-LIKE ODOR

BOILING POINT: 104 F (40 C) MELTING POINT: -139 F (-95 C)

SPECIFIC GRAVITY: 1.3266 VOLATILITY: 100%

VAPOR PRESSURE: 400 MMHG @ 24 C EVAPORATION RATE: (BUTYL ACETATE=1) 27.5

SOLUBILITY IN WATER: 1.32% @ 20 C ODOR THRESHOLD: 25-50 P

VAPOR DENSITY: 2.9

SOLVENT SOLUBILITY: SOLUBLE IN ALCOHOL, ETHER, DIMETHYLFORMAMIDE, PHENOLS,
ALDEHYDES, KETONES, GLACIAL ACETIC ACID, TRIETHYL PHOSPHATE, ACETOACETIC ACID,
CYCLOHEXYLAMINE, CHLORINATED SOLVENTS.

VISCOSITY: 0.441 CPS @ 20 C

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:

SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

UPPER EXPLOSIVE LIMIT: 22% LOWER EXPLOSIVE LIMIT: 14%

AUTOIGNITION TEMP.: 1033 F (556 C) FLAMMABILITY CLASS(OSHA): IIIB

PRODUCT NAME Nitrogen	CAS # 7727-37-9
TRADE NAME AND SYNONYMS Nitrogen	DOT ID No UN 1066
CHEMICAL NAME AND SYNONYMS Nitrogen	DOT Hazard Class Nonflammable gas
	Formula: N ₂
ISSUE DATE AND REVISIONS 25 November 1985	Chemical Family Inert gas

HEALTH HAZARD DATA

TIME WEIGHTED AVERAGE EXPOSURE LIMIT Nitrogen is defined as a simple asphyxiant. Oxygen levels should be maintained at greater than 18 molar percent at normal atmospheric pressure which is equivalent to a partial pressure of 135 mm Hg (ACGIH, 1985-86).

SYMPTOMS OF EXPOSURE

Effects of exposure to high concentrations so as to displace the oxygen in air necessary for life may include any, all or none of the following:

o Loss of balance or dizziness;

o Tightness in the frontal area of the forehead; (Continued on last page)

TOXICOLOGICAL PROPERTIES

Nitrogen is nontoxic but the liberation of a large amount in a confined area could displace the amount of oxygen in air necessary to support life.

RECOMMENDED FIRST AID TREATMENT

PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO NITROGEN. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Inhalation: Conscious persons should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, given mouth-to-mouth resuscitation, and supplemental oxygen. Further treatment should be symptomatic and supportive.

Information contained in this material safety data sheet is offered without charge for use by technically qualified personnel at their discretion and risk. All statements, technical information and recommendations contained herein are based on tests and data which we believe to be reliable, but the accuracy or completeness thereof is not guaranteed and no warranty of any kind is made with respect thereto. This information is not intended as a license to operate under or a recommendation to practice or infringe any patent of this Company or others covering any process, composition of matter or use.

Since the Company shall have no control of the use of the product described herein, the Company assumes no liability for loss or damage incurred from the proper or improper use of such product.

HAZARDOUS MIXTURES OF OTHER LIQUIDS, SOLIDS, OR GASES

None

PHYSICAL DATA

BOILING POINT -320.5°F (-195.8°C)	LIQUID DENSITY AT BOILING POINT 50.46 lb/ft ³ (808.3 kg/m ³)
VAPOR PRESSURE @ 70°F (21.1°C) above the critical temp. of -232.6°F (-147°C)	GAS DENSITY AT 70°F, 1 atm .0725 lb/ft ³ (1.161 kg/m ³)
SOLUBILITY IN WATER Very slightly	FREEZING POINT -345.9°F (-209.9°C)
EVAPORATION RATE N/A	SPECIFIC GRAVITY (AIR=1) @ 70°F (21.1°C) = 0.97
APPEARANCE AND ODOR Colorless, odorless gas	

FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method used)	AUTO IGNITION TEMPERATURE	FLAMMABLE LIMITS % BY VOLUME
N/A	N/A	LEL N/A UEL N/A
EXTINGUISHING MEDIA	ELECTRICAL CLASSIFICATION	
Nonflammable, inert gas	Nonhazardous	
SPECIAL FIRE FIGHTING PROCEDURES		
N/A		
UNUSUAL FIRE AND EXPLOSION HAZARDS		
N/A		

REACTIVITY DATA

STABILITY Unstable	CONDITIONS TO AVOID
Stable	X N/A
INCOMPATIBILITY (Materials to avoid) None	
HAZARDOUS DECOMPOSITION PRODUCTS None	
HAZARDOUS POLYMERIZATION May Occur	CONDITIONS TO AVOID
Will Not Occur	X N/A

SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED
Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in container or container valve, contact your closest supplier location or call the emergency telephone number listed herein.

WASTE DISPOSAL METHOD

Do not attempt to dispose of waste or unused quantities. Return in the shipping container properly labeled, with any valve outlet plugs or caps secured and valve protection cap in place to your supplier. For emergency disposal assistance, contact your closest supplier location or call the emergency telephone number listed herein.

RESPIRATORY PROTECTION (Specify type) Positive pressure air line with mask or self-contained breathing apparatus should be available for emergency use.

VENTILATION	LOCAL EXHAUST	SPECIAL
See Local Exhaust on last page	(See last page)	N/A
	MECHANICAL (Gen.)	OTHER
	N/A	N/A

PROTECTIVE GLOVES

Any material

EYE PROTECTION

Safety goggles or glasses

OTHER PROTECTIVE EQUIPMENT

Safety shoes

SPECIAL PRECAUTIONS*

SPECIAL LABELING INFORMATION

DOT Shipping Name: Nitrogen or Nitrogen, Compressed DOT Hazard Class: Nonflammable gas
DOT Shipping Label: Nonflammable gas I.D. No.: UN 1066

SPECIAL HANDLING RECOMMENDATIONS

Use only in well-ventilated areas. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure (<3,000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

For additional handling recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14 and Safety Bulletin SB-2.

SPECIAL STORAGE RECOMMENDATIONS

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 130F (54C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in - first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional storage recommendations, consult Compressed Gas Association's Pamphlets P-1, P-9, P-14 and Safety Bulletin SB-2.

SPECIAL PACKAGING RECOMMENDATIONS

Nitrogen is noncorrosive and may be used with any common structural material.

OTHER RECOMMENDATIONS OR PRECAUTIONS

Compressed gas cylinders should not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with his (written) consent is a violation of Federal Law (49CFR).

HEALTH HAZARD DATA (Continued)

SYMPTOMS OF EXPOSURE: (Continued)

- o Tingling of the tongue, fingertips or toes;
- o Weakened speech leading to the inability to utter sounds;
- o Rapid reduction in the ability to perform movements;
- o Reduced consciousness of the surroundings;
- o Loss of tactile sensations;
- o Heightened mental activity.

It should be recognized that it is possible that none of the above symptoms may occur in nitrogen asphyxia so that there are no definite warning symptoms.

SPECIAL PROTECTION INFORMATION (Continued)

LOCAL EXHAUST: (Continued)

To prevent accumulation of high concentrations so as to reduce the oxygen level in the air to less than 18 molar percent.

Material Safety Data Sheet



Paratherm Corporation
NF Heat Transfer Fluid

I. PRODUCT IDENTIFICATION

Manufacturer's Name	Paratherm Corporation	CAS Number: 8042-47-5
Address	1050 Colwell Lane Conshohocken, PA 19428	NFPA Hazard Identification
Emergency Telephone No.	(215) 941-4900	Degree of Hazard
Trade Name	Paratherm NF	Health: 0 Fire: 1 Reactivity: 0
		Hazard Ratings 0 — Least 1 — Slight 2 — Moderate 3 — High 4 — Extreme

II. INGREDIENTS

COMPONENT NAME	CAS NUMBER	HAZARDOUS IN BLEND	PERCENTAGE Min. Max.	COMPONENT EXPOSURE LIMITS	UNITS
White Mineral Oil	8042-47-5	No	100.00	OSHA PEL ACGIH TLV	No limit No limit

III. HEALTH EFFECT INFORMATION

EYE CONTACT	Paratherm NF is non-irritating to the eyes upon direct contact.
SKIN CONTACT	Paratherm NF is not expected to cause any skin irritation upon direct single or repeated and prolonged contact; however, similar chemical composition products applied to the skin of laboratory animals resulted in minimal to slight dermal irritation.
INHALATION	Paratherm NF has a low vapor pressure and is not expected to present an inhalation hazard at ambient conditions. Caution should be taken to prevent aerosolization or misting. The permissible exposure limit (PEL) and threshold limit value (TLV) for the fluid as oil mist is 5 mg/m ³ . Exposures below 5 mg/m ³ appear to be without significant health risk.
INGESTION	Ingestion is relatively non-toxic unless aspiration occurs. Paratherm NF has laxative properties and may result in abdominal cramps and diarrhea. See Health Data Section below.
HEALTH DATA	On rare occasions, prolonged and repeated exposure to oil mist poses a risk of pulmonary disease such as chronic lung inflammation. This condition is usually asymptomatic as a result of repeated small aspirations. Shortness of breath and cough are the most common symptoms. Aspiration may lead to chemical pneumonitis which is characterized by pulmonary edema and hemorrhage, and may be fatal. Signs of lung involvement include increased respiration rate, increased heart rate, and a bluish discoloration of the skin. Coughing, choking, and gagging are often noted at the time of aspiration. Gastrointestinal discomfort may develop, followed by vomiting, with a further risk of aspiration.

IV. EMERGENCY & FIRST AID PROCEDURES

EYE CONTACT	Immediately flush eyes with large amounts of water and continue flushing for 15 minutes. If fluid is hot, treat for thermal burns and take victim to hospital immediately.
SKIN CONTACT	Remove contaminated clothing. If fluid is hot, submerge injured area in cold water. If victim is severely burned, take to a hospital immediately.
INHALATION	Paratherm NF has a low vapor pressure and is not expected to present an inhalation exposure at ambient conditions. If vapor or mist is generated when the fluid is heated or handled, remove victim from exposure. If breathing has stopped or is irregular, administer artificial respiration and supply oxygen if it is available. If victim is unconscious, remove to fresh air and seek medical attention.
INGESTION	May act as a laxative. Do not induce vomiting.

V. PERSONAL HEALTH PROTECTION INFORMATION

EYE PROTECTION	Eye protection is not required under conditions of normal use. If the fluid is handled such that it could be splashed into eyes, wear plastic face shield or splash-proof safety goggles.
SKIN PROTECTION	No skin protection is required for single, short duration exposures. For prolonged or repeated exposures, use impervious synthetic rubber clothing (boots, gloves, aprons, etc.) over parts of the body subject to exposure. If handling hot fluid, use insulated protective clothing (boots, gloves, aprons, etc.).
RESPIRATORY PROTECTION	Respiratory protection is not required under conditions of normal use. If vapor or mist is generated when the fluid is heated or handled, use an organic vapor respirator with a dust and mist filter. All respirators must be NIOSH certified. Do not use compressed oxygen in hydrocarbon atmospheres.
VENTILATION	If vapor or mist is generated when the fluid is heated or handled, adequate ventilation in accordance with good engineering practice must be provided to maintain concentrations below the specified exposure or flammable limits.
OTHER	Consumption of food and beverages should be avoided in work areas where hydrocarbons are present. Always wash hands and face with soap and water before eating, drinking or smoking.

VI. FIRE PROTECTION INFORMATION

FLASH POINT	340F
FIRE POINT	385F
AUTOIGNITION TEMPERATURE	690F

TEST METHOD	c.o.c.
TEST METHOD	c.o.c.
TEST METHOD	ASTM D-2155

FLAMMABLE LIMITS IN AIR % BY VOL.	LOWER	No data	UPPER	No data
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EXTINGUISHING MEDIA

Use dry chemical, foam, or carbon dioxide.

SPECIAL FIRE FIGHTING PROCEDURES

Water may be ineffective but can be used to cool containers exposed to heat or flame. Caution should be exercised when using water or foam as frothing may occur, especially if sprayed into containers of hot, burning liquid.

UNUSUAL FIRE AND EXPLOSIVE CONDITIONS

Dense smoke may be generated while burning. Carbon monoxide, carbon dioxide, and other oxides may be generated as products of combustion.

VII. REACTIVITY DATA

STABILITY (THERMAL, LIGHT, ETC.)

Stable

CONDITIONS TO AVOID

None

HAZARDOUS POLYMERIZATION

Will not occur

CONDITIONS TO AVOID

None

INCOMPATIBILITY MATERIALS TO AVOID

May react with strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

None

VIII. ENVIRONMENTAL PRECAUTIONS

STEPS TO BE TAKEN IF FLUID IS RELEASED OR SPILLED

Consult health effect information in Section III. Personal Health Protection Information in Section V. Fire Protection Information in Section VI. and Reactivity Data in Section VII. Notify appropriate authorities of spill. Contain spill immediately. Do not allow spill to enter sewers or water courses; remove all sources of ignition. Absorb with appropriate inert material such as sand, clay, etc. Large spills may be picked up using vacuum pumps, shovels, buckets or other means and placed in drums or other suitable containers.

WASTE DISPOSAL METHOD

All disposals must comply with federal, state and local regulations. The fluid, if spilled or discarded, may be a regulated waste. Refer to state and local regulations. Caution: if regulated solvents are used to clean up spilled fluid, the resulting waste mixture may be regulated. Department of Transportation (DOT) regulations may apply for transporting this material when spilled. Waste material may be landfilled or incinerated at an approved facility. Materials should be recycled if possible.

IX. MISCELLANEOUS

HANDLING AND STORAGE REQUIREMENTS

Do not transfer to unmarked containers. Store in closed, containers away from heat, sparks, open flame, or oxidizing materials. Paratherm NF is not classified as hazardous under DOT regulations. Fire extinguishers should be kept readily available. See NFPA 30 and OSHA 1910.106—Flammable and combustible liquids.

ADDITIONAL INFORMATION

No additional information.

X. PHYSICAL PROPERTIES

BOILING POINT	IBP (Approx.) 570F	PERCENT VOLATILE	Nil @ Ambient Temperature
MELTING POINT	N/A	VAPOR DENSITY (AIR=1)	> 1
APPEARANCE	Clear liquid	EVAPORATION RATE (EE=1)	< 1
DOR	Odorless	SPECIFIC GRAVITY	Approx. 0.87 @ 60/60F
VAPOR PRESSURE	< 1 mm Hg @ 70F	MOLECULAR WEIGHT	Varies
SOLUBILITY	Negligible in water. Soluble in hydrocarbons.		

* MONSANTO PRODUCT NAME

Polychlorinated Biphenyls (PCBs)

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

Date: 10/88

PRODUCT IDENTIFICATION

Synonyms: PCBs
Chlorodiphenyl (___% Cl)
Chlorinated biphenyl
Polychlorinated biphenyl
Chlorinated biphenyls
(approx. ___% Cl)

Trade Names/

Common Names: Aroclor®¹ Series 1016, 1221, 1232, 1242, 1248, 1254, 1260
Therminol®¹ FR Series

PYRANOL®² and INERTEEN®³ are trademarks for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL - Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

This list of trade names is representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

¹ Registered trademark of Monsanto Company

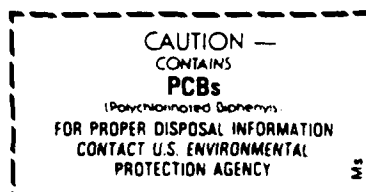
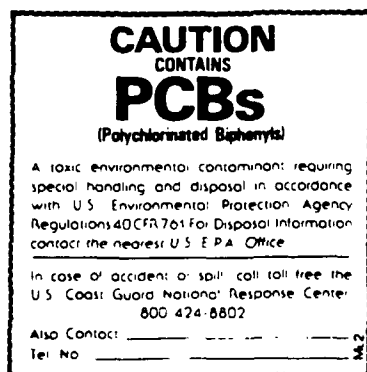
² Registered trademark of General Electric Company

³ Registered trademark of Westinghouse Electric Corporation

CAS No.'s: 001336363, 053469219, 021672296, 01109769, 011096825 and others

WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked. (check regulations, 40 CFR 761, for details)



MATERIAL SAFETY DATA Polychlorinated Biphenyls (PCBs)

PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

EMERGENCY AND FIRST AID PROCEDURES

- Ingestion:** Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—If large amounts are ingested, gastric lavage is suggested.
- Skin:** If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—Hot PCBs may cause thermal burns.
- Eyes:** Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.
- Inhalation:** Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

OCCUPATIONAL CONTROL PROCEDURES

- Eye Protection:** Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.
- Skin Protection:** Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling.
- Respiratory Protection:** *ATTENTION!* Repeated or prolonged contact may cause chloracne in some people. Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.
- Ventilation:** Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.
- Airborne Exposure Limits:** Chlorinated biphenyl (approximately 42% chlorine)
- OSHA PEL: 1 mg/m³ 8-hour time-weighted average - Skin*
 - ACGIH TLV: 1 mg/m³ 8-hour time-weighted average - Skin*
 - 2 mg/m³ short-term exposure limit - Skin*

*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

(OCCUPATIONAL CONTROL PROCEDURES continued on page 3)

OCCUPATIONAL CONTROL PROCEDURES (continued)

Airborne

Exposure Limits

(Continued):

Chlorinated biphenyl (approximately 54% chlorine)

OSHA PEL: 0.5 mg/m³ 8-hour time-weighted average - Skin*

ACGIH TLV: 0.5 mg/m³ 8-hour time-weighted average - Skin*

1 mg/m³ short-term exposure limit - Skin*

*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

FIRE PROTECTION INFORMATION

Fire and

Explosion:

PCBs are fire-resistant compounds. They may decompose to form CO, CO₂, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 600-650°C in the presence of excess of oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

HEALTH EFFECTS SUMMARY

Skin Contact:

PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

Eye Contact:

The liquid products and their vapors are moderately irritating to eye tissues.

Ingestion:

The acute oral toxicities of the undiluted compounds are: LD₅₀ rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

Inhalation:

Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

(HEALTH EFFECTS SUMMARY continued on page 4)

HEALTH EFFECTS SUMMARY (continued)

Other:

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route, if the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Fourth).

PHYSICAL DATA

PROPERTIES OF SELECTED AROCLORS®

PROPERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x/15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g, maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point	none to boiling point	none to boiling point	none to boiling point
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—Not Available

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

SPILL, LEAK & DISPOSAL INFORMATION

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state and local regulations may require immediate reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

ENVIRONMENTAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquids or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

ADDITIONAL COMMENTS

Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives.

In 1972 Monsanto restricted sales of PCBs to applications involving only closed electrical systems (transformers and capacitors). In 1977 all manufacturing and sales were voluntarily terminated. In 1979 EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

Monsanto MATERIAL SAFETY DATA

Page 6 of 6

DATE: 10/1/88

SUPERSEDES: All prior to 10/1/88

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

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Product & Environmental Safety Director

Paul R. Michael
Product & Environmental Safety Manager

Environmental Policy Staff
Monsanto Company
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St. Louis, Missouri 63167
(314) 694-4764

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

Note: Although the information and recommendations set forth (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, TX 48674 Emergency Phone: 517-636-4400

Product Code: 68439

Page: 1

Product Name: POLYGLYCOL E-400

Effective Date: 06/07/90

Date Printed: 11/20/90

MSD: 000096

1. INGREDIENTS: (% w/w, unless otherwise noted)

Polyethylene glycol

CAS# 025322-68-3 >99%

This document is prepared pursuant to the OSHA Hazard Communication Standard (29 CFR 1910.1200). In addition, other substances not 'Hazardous' per this OSHA Standard may be listed. Where proprietary ingredient shows, the identity may be made available as provided in this standard.

2. PHYSICAL DATA:

BOILING POINT: Decomposes.

VAP PRESS: Low.

VAP DENSITY: Not appl.

SOL. IN WATER: Completely miscible.

SP. GRAVITY: 1.12 @ 25/25C

APPEARANCE: Clear, colorless liquid.

ODOR: Information not available.

3. FIRE AND EXPLOSION HAZARD DATA:

FLASH POINT: >450F, >232C

METHOD USED: FMCC

FLAMMABLE LIMITS

LFL: Not determined.

UFL: Not determined.

EXTINGUISHING MEDIA: Water fog, alcohol foam, dry chemical.

FIRE & EXPLOSION HAZARDS: Information not available.

FIRE-FIGHTING EQUIPMENT: Wear positive-pressure, self-contained breathing apparatus.

4. REACTIVITY DATA:

STABILITY: (CONDITIONS TO AVOID) Product degrades slowly when stored at elevated temperatures in presence of air. Degradation occurs rapidly at temperatures approaching the flash point.

(Continued on Page 2)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 68439
Product Name: POLYGLYCOL E-400

Page: 2

Effective Date: 06/07/90 Date Printed: 11/20/90

MSD: 000096

1. REACTIVITY DATA: (CONTINUED)

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Oxidizing material, concentrated mineral acids.

HAZARDOUS DECOMPOSITION PRODUCTS: None known.

HAZARDOUS POLYMERIZATION: Will not occur.

5. ENVIRONMENTAL AND DISPOSAL INFORMATION:

ACTION TO TAKE FOR SPILLS/LEAKS: Should not be left on floor - makes it slippery. Soak up with suitable absorbent material. Scoop into drums.

DISPOSAL METHOD: Salvage or burn in an approved incinerator in accordance with all federal, state, and local requirements.

HEALTH HAZARD DATA:

EYE: May cause slight transient (temporary) eye irritation.

SKIN CONTACT: Prolonged or repeated exposure not likely to cause significant skin irritation. May cause more severe response if skin is abraded (scratched or cut).

SKIN ABSORPTION: A single prolonged exposure is not likely to result in the material being absorbed through skin in harmful amounts. The LD50 for skin absorption in rabbits is greater than 20 g/kg. There is some indication that prolonged or repeated exposure of damaged skin, as in burn wounds, to polyethylene glycol may result in absorption of toxic amounts.

INGESTION: Single dose oral toxicity is low. The oral LD50 for rats is >30 grams/kg. No hazards anticipated from ingestion incidental to industrial exposure.

INHALATION: Vapors are unlikely at room temperature due to physical properties.

(Continued on Page 3)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 68439
Product Name: POLYGLYCOL E-400

Page: 3

Effective Date: 06/07/90 Date Printed: 11/20/90 MSD: 000096

5. HEALTH HAZARD DATA: (CONTINUED)

SYSTEMIC & OTHER EFFECTS: Based on available data, repeated exposures are not anticipated to cause any significant adverse effects. Findings of kidney failure and death in burn patients, as well as some studies using animal burn models, suggest that polyethylene glycol may have been a factor. The use of topical applications containing polyethylene glycol may not be appropriate in severely burned patients or individuals with impaired renal function. Polyethylene glycols did not cause cancer in long-term animal studies.

7. FIRST AID:

EYES: Irrigate immediately with water for at least 5 minutes.

SKIN: Wash off in flowing water or shower.

INGESTION: No adverse effects anticipated by this route of exposure incidental to proper industrial handling.

INHALATION: No adverse effects anticipated by this route of exposure incidental to proper industrial handling.

NOTE TO PHYSICIAN: No specific antidote. Supportive care. Treatment based on judgment of the physician in response to reactions of the patient. Absorption may be promoted by damaged skin. Tox & Appl. Pharmac. 23:263 1982.

3. HANDLING PRECAUTIONS:

EXPOSURE GUIDELINE(S): American industrial hygiene association workplace environmental exposure level is 10 mg/m³ for polyethylene glycols.

VENTILATION: Good general ventilation should be sufficient for most conditions.

RESPIRATORY PROTECTION: If respiratory irritation is experienced, use an approved air-purifying respirator.

SKIN PROTECTION: No precautions other than clean body-covering

(Continued on Page 4)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 68439

Page: 4

Product Name: POLYGLYCOL E-400

Effective Date: 06/07/90

Date Printed: 11/20/90

MSD: 000096

3. HANDLING PRECAUTIONS: (CONTINUED)

clothing should be needed. Protective clothing may be necessary when individual skin is abraded.

EYE PROTECTION: Use safety glasses.

7. ADDITIONAL INFORMATION:

SPECIAL PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Observe reasonable care and cleanliness.

Trace quantities of ethylene oxide (EO) may be present in this product. While these trace quantities could accumulate in headspace areas of storage and transport vessels, they are not expected to create a condition which will result in EO concentrations greater than 0.5 ppm (8 hour TWA) in the breathing zone of the workplace for appropriate applications. OSHA has established a permissible exposure limit of 1.0 ppm 8 hr TWA for EO. (Code of Federal Regulations Part 1910.1047 of Title 29.)

This product may decompose at elevated temperatures generating vapors which could be irritating. For uses at elevated temperatures adequate ventilation or exhaust is recommended.

MSDS STATUS: Revised section 9 and regsheet.

(Continued on Page 5)

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M A T E R I A L S A F E T Y D A T A S H E E T

Dow Chemical U.S.A.* Midland, MI 48674 Emergency Phone: 517-636-4400

Product Code: 68439

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Product Name: POLYGLYCOL E-400

Effective Date: 06/07/90

Date Printed: 11/20/90

MSD: 000096

REGULATORY INFORMATION: (Not meant to be all-inclusive-- selected regulations represented.)

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations. See MSD Sheet for health and safety information.

U.S. REGULATIONS

=====

SARA HAZARD CATEGORY: This product has been reviewed according to the "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

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SECTION V HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE

None assigned

EFFECTS OF OVEREXPOSURE

Low hazard

EMERGENCY AND FIRST-AID PROCEDURES

None indicated

SECTION VI REACTIVITY DATA

STABILITY

UNSTABLE

CONDITIONS TO AVOID

STABLE X

INCOMPATIBILITY

(Materials to avoid)

Strong oxidizers

HAZARDOUS

DECOMPOSITION PRODUCTS

Thermal decomposition or burning may produce carbon monoxide and/or carbon dioxide

HAZARDOUS POLYMERIZATION

CONDITIONS TO AVOID

May Occur

Will Not Occur

X

SECTION VII SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN

IN CASE MATERIAL IS
RELEASED OR SPILLED

Absorb spilled material on vermiculite. Place in fiber carton.
Incinerate. Wash spill area well with soap and water.

WASTE DISPOSAL METHOD

Incinerate. State and local laws take precedence.

SECTION VIII SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION

(Specify Type)

No

VENTILATION

LOCAL EXHAUST

No

SPECIAL

No

MECHANICAL (general)

No

OTHER

No

PROTECTIVE GLOVES

No

EYE PROTECTION

No

OTHER

PROTECTIVE
EQUIPMENT

No

SECTION IX SPECIAL PRECAUTIONS

PRECAUTIONS TO BE
TAKEN IN HANDLING
AND STORING

None

OTHER PRECAUTIONS

None

15412

MATERIAL SAFETY DATA SHEET

SECTION I

PRODUCT NAME	Polyethylene Glycol 400	SIZE	1 kg, 3 kg
CHEMICAL NAME	Polyethylene Glycol 400	SCD NO. =	15412
FORMULA	$\text{H}(\text{OCH}_2\text{CH}_2)_x\text{OH}$	ACC NO. =	911005
MANUFACTURER	EASTMAN KODAK COMPANY	M1# =	R-0299.600
ADDRESS	343 STATE STREET, ROCHESTER, NEW YORK 14650	CAS REG. NO. =	25322-05-3
		PHONE NO.:	(716) 722-5151

FOR INFORMATION ON HEALTH HAZARDS CALL

FOR OTHER INFORMATION CALL (716) 722-2121

INFORMATION EFFECTIVE AS OF 8/29/79

SECTION II HAZARDOUS INGREDIENTS OF MIXTURES

PRINCIPAL HAZARDOUS COMPONENT(S)	%	TLV (Units)
Not Applicable		

SECTION III PHYSICAL DATA

Melting BOILING POINT (°F) 39-50°F (4-10°C)	SPECIFIC GRAVITY (H ₂ O=1) 1.11 to 1.14 (25/25)
VAPOR PRESSURE (mm Hg) Not Available	PERCENT VOLATILE BY VOLUME (%) 100
VAPOR DENSITY (AIR=1) Not Applicable	EVAPORATION RATE (=1) ----
SOLUBILITY IN WATER Appreciable	

APPEARANCE AND ODOR Colorless viscous liquid; slight odor

SECTION IV FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used) 471°F (244°C)	FLAMMABLE LIMITS Not Available	LeI	Uel
EXTINGUISHING MEDIA CO ₂ , dry chemical, water			
SPECIAL FIRE-FIGHTING PROCEDURES Air mask should be worn			
UNUSUAL FIRE AND EXPLOSION HAZARDS None			

J. . Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone -- (201) 859-2151

Chemtrec # (800) 424-8300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

P5884 -01
Effective: 10/08/85

Potassium Hydroxide

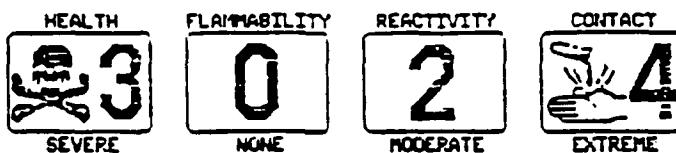
Page:
Issued: 10/09/85

SECTION I - PRODUCT IDENTIFICATION

Product Name: Potassium Hydroxide
Formula: KOH
Formula Wt: 56.11
CAS No.: 01310-58-3
NIOSH/RTECS No.: TT2102000
Common Synonyms: Potassium Hydrate
Product Codes: 3141, 3150, 3146, 3147, 5342, 3142, 3140, 5085

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System



Laboratory Protective Equipment



Precautionary Label Statements

POISON! DANGER!
CAUSES SEVERE BURNS
MAY BE FATAL IF SWALLOWED

Do not get in eyes, on skin, on clothing.

Avoid breathing dust. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component

Potassium Hydroxide

CAS No
85-100 1310-58-

SECTION III - PHYSICAL DATA

Boiling Point: 1320°C (2408°F)

Vapor Pressure(mmHg): N/A

Melting Point: 360°C (680°F)

Vapor Density(air=1): N/A

Continued on Page: 2

P5884 -01
Effective: 10/08/85

Potassium Hydroxide

Page: 2
Issued: 10/09/85

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 2.04
(H₂O=1)

Evaporation Rate: N/A
(Butyl Acetate=1)

Solubility(H₂O): Complete (in all proportions) % Volatiles by Volume: 0

Appearance & Odor: White or slightly yellow pellets; no odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

NFPA 704M Rating: 3-0-1

Fire Extinguishing Media
Use water spray.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

SECTION V - HEALTH HAZARD DATA

Threshold Limit Value (TLV/TWA): 2 mg/m³ (ppm)

Effects of Overexposure

Contact with skin or eyes may cause severe irritation or burns.
Excessive inhalation of dust is irritating and may be severely damaging to respiratory passages and/or lungs.
Ingestion may cause severe burning to mouth and stomach.

Emergency and First Aid Procedures

If swallowed, do NOT induce vomiting; if conscious, give large amounts of water. Follow with diluted vinegar, fruit juice or whites of eggs, beaten with water.
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash clothing before re-use.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture

Incompatibles: water, strong acids, organic materials

J.T.Baker

J. T. Baker Chemical Co.

222 Red School Lane Phillipsburg, N.J. 08865
24-Hour Emergency Telephone - (201) 859-2151

Chemirec # (800) 424-9300
National Response Center # (800) 424-8802

MATERIAL
SAFETY
SHEET

P5884 -01

Potassium Hydroxide

Effective: 10/08/85

Issued: 10

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.
With clean shovel, carefully place material into clean, dry container
cover; remove from area. Flush spill area with water.

J. T. Baker Neutracid-2^R caustic neutralizer is recommended
for spills of this product.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local
environmental regulations.

EPA Hazardous Waste Number: D002, D003 (Corrosive, Reactive Waste)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet
TLU requirements.

Respiratory Protection: None required where adequate ventilation
conditions exist. If airborne concentration is
high, a dust/mist respirator is recommended.
If concentration exceeds capacity of respirator,
a self-contained breathing apparatus is advised.

Eye/Skin Protection: Safety goggles, uniform, apron, neoprene gloves
are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: White Stripes

Special Precautions

Keep container tightly closed. Store in corrosion-proof area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Potassium hydroxide, dry solid
Hazard Class	Corrosive material (solid)
UN/NA	UN1813
Labels	CORROSIVE
Reportable Quantity	1000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Potassium hydroxide, dry solid
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S4106 -01

Sodium Hypochlorite, 5% Solution

10 Page 1-1

Effective: 05/22/86

Issued: 05/23/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Sodium Hypochlorite, 5% Solution
 Formula: NaOCl
 Formula Wt. 74.44
 CAS No.: 7681-52-9
 NIOSH/RTECS No.: NH3486300
 Common Synonyms: Hypochlorous Acid, Sodium Salt; Clorox
 Product Codes: 9416

PRECAUTIONARY LABELLING

BAKER SAF-T-DATA™ System

HEALTH	FLAMMABILITY	REACTIVITY	CONTACT
1	0	1	1
SLIGHT	NONE	SLIGHT	SLIGHT

Laboratory Protective Equipment



Precautionary Label Statements

WARNING:
 CAUSES BURNS
 HARMFUL IF SWALLOWED

Avoid contact with eyes, skin, clothing.

Avoid breathing vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

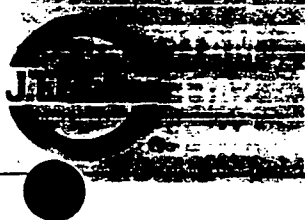
SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Sodium Hypochlorite	0-5	7681-52-9

SECTION III - PHYSICAL DATA

Boiling Point:	N/A	Vapor Pressure (mmHg):	18
Melting Point:	N/A	Vapor Density (air=1):	2.5

Continued on Page: 2



54106 -01
Effective: 05/22/86

Sodium Hypochlorite, 5% Solution

Page: 2
Issued: 05/23/86

SECTION III - PHYSICAL DATA (Continued)

Specific Gravity: 1.09
(H₂O=1)

Evaporation Rate: N/A
(Butyl Acetate=1)

Solubility(H₂O): Appreciable (more than 10 %) % Volatiles by Volume: 100

Appearance & Odor: Light yellow to clear liquid.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained breathing apparatus with full facepiece operated in positive pressure mode.

Toxic Gases Produced

chlorine and chlorine compounds

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Liquid may cause burns to skin and eyes.
Vapors may be irritating to skin, eyes, nose and throat.
Ingestion may cause severe burning to mouth and stomach.

Emergency and First Aid Procedures

CALL A PHYSICIAN.
If swallowed, if conscious, give large amount of milk, milk of magnesia, or whites of eggs beaten with water. Induce vomiting.
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.
Wash clothing before re-use.

SECTION VI - REACTIVITY DATA

Stability: Stable

Hazardous Polymerization: Will not occur

Conditions to Avoid: moisture, heat, light

Incompatibles: strong acids, chlorine, strong reducing agents, organic materials, aluminum



J. T. Baker Chemical Company

222 Red School House Road, Piquette, Michigan 48675

24-Hour Emergency Telephone: (201) 855-2151

Chemtrec # (800) 424-9300

National Response Center # (800) 424-9302

SHEET

S4106 -01

Sodium Hypochlorite, 5% Solution

Effective: 05/22/86

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SECTION VI - REACTIVITY DATA (Continued)

Decomposition Products: chlorine and chlorine compounds

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear suitable protective clothing. Take up with sand or other noncombustible absorbent material and place into container for later disposal. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use adequate general or local exhaust ventilation to keep vapor and mist levels as low as possible.

Respiratory Protection: None required where adequate ventilation conditions exist. If airborne concentration is high, use an appropriate respirator or dust mask.

Eye/Skin Protection: Safety goggles, uniform, apron, rubber gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Orange

Special Precautions

Keep container tightly closed. Suitable for any general chemical storage area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Hypochlorite solution (< 7% Cl by wt.) (air only)
Hazard Class	ORM-B
UN/NA	NA1791
Labels	NONE
Reportable Quantity	100 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Hypochlorite, solution (> 5% available chlorine)
Hazard Class	3



J. T. Baker Chemical Co.

222 Red School Lane Philadelphia, NJ 19106
24-Hour Emergency Telephone: (201) 858-2151

Chemtrec # (800) 424-9300
National Response Center # (800) 424-9302

S4106 -01

Sodium Hypochlorite, 5% Solution

Page: 4

Effective: 05/22/86

Issued: 05/23/86

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION (Continued)

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UN/NA	UN1791
Labels	CORROSIVE

=====

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

DATE: 01/24/90
INDEX: 11900220074

ACCT: 224747-02
CAT NO: A510-212

PAGE: 1
PO NBR: 76462.01

SULFURIC ACID
SULFURIC ACID
SULFURIC ACID

MATERIAL SAFETY DATA SHEET

FISHER SCIENTIFIC
CHEMICAL DIVISION
1 REAGENT LANE
FAIR LAWN NJ 07410
(201) 796-7100

EMERGENCY NUMBER: (201) 796-7100
CHEMTREC ASSISTANCE: (800) 424-9300

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SUBSTANCE IDENTIFICATION

SUBSTANCE: ***SULFURIC ACID***

CAS-NUMBER 7664-93-9

TRADE NAMES/SYNONYMS:

OIL OF VITRIOL; BOV; DIPPING ACID; VITRIOL BROWN OIL; HYDROGEN SULFATE;
NORDHADSEN ACID; DIHYDROGEN SULFATE; SULPHURIC ACID; MATTING ACID;
DITHIONIC ACID; STCC 4930040; UN 1830; A-300; A-300C; A-300-SI; A-300S;
A-298; A-510; A-468; SO-A-172; SO-A-174; ACC22350

CHEMICAL FAMILY:
INORGANIC ACID

MOLECULAR FORMULA: H2-S-O4

MOLECULAR WEIGHT: 98.07

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=0 REACTIVITY=2 PERSISTENCE=0
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=0 REACTIVITY=2

COMPONENTS AND CONTAMINANTS

COMPONENT: SULFURIC ACID PERCENT: 98

COMPONENT: WATER PERCENT: 2

OTHER CONTAMINANTS: NONE

EXPOSURE LIMITS:

SULFURIC ACID:
1 MG/M3 OSHA TWA
1 MG/M3 ACGIH TWA; 3 MG/M3 ACGIH STEL
1 MG/M3 NIOSH RECOMMENDED 10 HOUR TWA

1000 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY
1000 POUNDS SARA SECTION 304 REPORTABLE QUANTITY
1000 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY
SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

PHYSICAL DATA

DESCRIPTION: ODORLESS, CLEAR, COLORLESS, DENSE HYGROSCOPIC OILY LIQUID WITH
A MARKED ACID TASTE WHEN PURE. BOILING POINT: 559 F (290 C)
MELTING POINT: 50 F (10 C) SPECIFIC GRAVITY: 1.84
VAPOR PRESSURE: <0.001 @ 20 C PH: <3 SOLUBILITY IN WATER: SOLUBLE
ODOR THRESHOLD: >1 MG/M3 VAPOR DENSITY: 3.4
SOLVENT SOLUBILITY: DECOMPOSES IN ETHYL ALCOHOL
@ 340 C IT DECOMPOSES INTO SULFUR TRIOXIDE AND WATER

FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD:
NEGLECTIBLE FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

OXIDIZER: OXIDIZERS DECOMPOSE, ESPECIALLY WHEN HEATED, TO YIELD OXYGEN OR
OTHER GASES WHICH WILL INCREASE THE BURNING RATE OF COMBUSTIBLE MATTER.
CONTACT WITH EASILY OXIDIZABLE, ORGANIC, OR OTHER COMBUSTIBLE MATERIALS
MAY RESULT IN IGNITION, VIOLENT COMBUSTION OR EXPLOSION.

DATE: 01/24/90
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FIREFIGHTING MEDIA:
WATER, DRY CHEMICAL, CARBON DIOXIDE OR HALON
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FOR LARGER FIRES, FLOOD AREA WITH WATER FROM A DISTANCE
(1987 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.4).

FIREFIGHTING:
DO NOT GET SOLID STREAM OF WATER ON SPILLED MATERIAL. *MOVE CONTAINERS FROM
FIRE AREA IF POSSIBLE. COOL CONTAINERS EXPOSED TO FLAMES WITH WATER FROM SIDE
UNTIL WELL AFTER FIRE IS OUT. KEEP AWAY FROM STORAGE TANK ENDS (1987 EMERGENCY
RESPONSE GUIDEBOOK, DOT P 5800.4 GUIDE PAGE 39).

USE AGENT SUITABLE FOR TYPE OF FIRE; USE FLOODING AMOUNTS OF WATER AS A FOG.
COOL CONTAINERS WITH FLOODING AMOUNTS OF WATER, APPLY FROM AS FAR A DISTANCE
AS POSSIBLE. AVOID BREATHING CORROSIVE VAPORS, KEEP UPWIND.

TRANSPORTATION DATA

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49CFR172.101:
CORROSIVE MATERIAL

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49CFR172.101 AND SUBPART E:
CORROSIVE

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49CFR173.272
EXCEPTIONS: 49CFR173.244

TOXICITY

SULFURIC ACID:
1380 UG EYE-RABBIT SEVERE IRRITATION; 100 MG EYE-RABBIT RINSED SEVERE
IRRITATION; 3 MG/M3/24 WEEKS INHALATION-HUMAN TCLO; 510 MG/M3/2 HOURS
INHALATION-RAT LC50; 320 MG/M3 2 HOURS INHALATION-MOUSE LC50; 18 MG/M3
INHALATION-GUINEA PIG LC50; 2140 MG/KG ORAL-RAT LD50; 135 MG/KG
UNREPORTED-MAN LDLO; TUMORIGENIC DATA (AJEPAS 120(3), 358, 84).
CARCINOGEN STATUS: NONE.

SULFURIC ACID IS HIGHLY TOXIC, AND A SEVERE EYE, SKIN AND MUCOUS MEMBRANE
IRRITANT. POISONING MAY AFFECT THE BODY'S PH BALANCE AND IN TURN AFFECT THE
NERVOUS SYSTEM.

HEALTH EFFECTS AND FIRST AID

INHALATION:

SULFURIC ACID:

CORROSIVE/HIGHLY TOXIC. 80 MG/M3 IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.
ACUTE EXPOSURE- INHALATION OF MISTS MAY CAUSE MUCOUS MEMBRANE IRRITATION
PRINCIPALLY AFFECTING THE RESPIRATORY TRACT EPITHELIUM. LOW
CONCENTRATIONS, 0.35-5 MG/M3, MAY CAUSE INCREASED PULMONARY AIR FLOW
RESISTANCE AND SUBSEQUENT SHALLOWER AND MORE RAPID BREATHING. HOT
CONCENTRATED MISTS MAY CAUSE RAPID LOSS OF CONSCIOUSNESS WITH POSSIBLE
DAMAGE TO LUNG TISSUE. VAPORS MAY CAUSE NASAL SECRETIONS, SNEEZING, A
BURNING OR TICKLING SENSATION IN THE NOSE AND THROAT AND RETROSTERNAL
REGION, FOLLOWED BY COUGH, RESPIRATORY DISTRESS, TRACHEOBRONCHITIS,
CHEMICAL PNEUMONITIS AND POSSIBLE SPASM OF THE VOCAL CORDS. HIGH
CONCENTRATIONS MAY PRODUCE BLOODY NASAL SECRETIONS AND SPUTUM, HEMATEMESIS
GASTRITIS, AND PULMONARY EDEMA. A SINGLE OVEREXPOSURE MAY LEAD TO
LARYNGEAL, TRACHEOBRONCHIAL AND PULMONARY EDEMA. ONE INDIVIDUAL SPRAYED
IN THE FACE WITH SULFURIC ACID LIQUID EXPERIENCED DELAYED SYMPTOMS OF
PULMONARY FIBROSIS, RESIDUAL BRONCHITIS, AND PULMONARY EMPHYSEMA.
VAPORS FROM DILUTE SOLUTIONS MAY IRRITATE MUCOUS MEMBRANES.
CHRONIC EXPOSURE- REPEATED EXPOSURE TO THE MIST MAY CAUSE INFLAMMATION
OF THE UPPER RESPIRATORY TRACT, CHRONIC BRONCHITIS AND ETCHING OF THE
DENTAL ENAMEL. THE CENTRAL AND LATERAL INCISORS ARE PRIMARILY AFFECTED.
REPEATED EXCESSIVE EXPOSURE OVER LONG PERIODS OF TIME HAVE RESULTED IN
BRONCHITIC SYMPTOMS, RHINORRHEA, FREQUENT RESPIRATORY TRACT INFECTIONS,
EMPHYSEMA, STOMATITIS AND DIGESTIVE DISTURBANCES. CHRONIC INHALATION
MAY CAUSE ALKALINE DEPLETION OF THE BODY PRODUCING AN ACIDOSIS WHICH
AFFECTS THE NERVOUS SYSTEM AND PRODUCES AGITATION, HESITANT GAIT AND
GENERALIZED WEAKNESS. AN EPIDEMIOLOGICAL STUDY OF WORKERS AT A REFINERY
AND CHEMICAL PLANT SUGGESTS AN INCREASED RISK OF LARYNGEAL CANCER
FROM EXPOSURE TO HIGH CONCENTRATIONS OF SULFURIC ACID.

FIRST AID- REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING
HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD
PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND
AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN
SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION
IMMEDIATELY.

SKIN CONTACT:

SULFURIC ACID:

CORROSIVE.

ACUTE EXPOSURE- CONTACT WITH CONCENTRATED SULFURIC ACID MAY CAUSE SEVERE
SECOND AND THIRD DEGREE SKIN BURNS WITH NECROSIS DUE TO ITS AFFINITY

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FOR WATER AND SUBSEQUENT SEVERE DEHYDRATING ACTION, AND ITS EXOTHERMIC REACTION WITH MOISTURE. POSSIBLE CHARRING MAY OCCUR LEADING TO SHOCK AND COLLAPSE DEPENDING ON THE AMOUNT OF TISSUE INVOLVED. THE RESULTING WOUNDS MAY BE LONG IN HEALING AND MAY CAUSE EXTENSIVE SCARRING THAT MAY RESULT IN FUNCTIONAL INHIBITION. CONTACT WITH DILUTE SOLUTIONS MAY CAUSE SKIN IRRITATION.

CHRONIC EXPOSURE- REPEATED CONTACT WITH LOW CONCENTRATIONS MAY CAUSE SKIN DESICCATION AND ULCERATION OF THE HANDS, AND PANARIS OR CHRONIC PURULENT INFLAMMATION AROUND THE NAILS. REPEATED CONTACT WITH DILUTE SOLUTIONS MAY CAUSE DERMATITIS.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT:
SULFURIC ACID:
CORROSIVE.

ACUTE EXPOSURE- EXPOSURE TO THE VAPORS MAY CAUSE A BURNING OR STINGING SENSATION IN THE EYES WITH LACRIMATION, BLURRED VISION AND CONJUNCTIVAL CONGESTION. SPLASHES OF ACID IN THE EYES MAY PRODUCE DEEP CORNEAL ULCERATION, KERATO-CONJUNCTIVITIS AND PALPEBRAL LESIONS WITH SEVERE SEQUELAE. IRREPARABLE CORNEAL DAMAGE AND BLINDNESS AS WELL AS SCARRING OF THE EYELIDS MAY OCCUR. SEVERE SULFURIC ACID EYE BURNS HAVE INCLUDED GLAUCOMA AND CATARACT AS COMPLICATIONS IN THE MOST SEVERE CASES. CONTACT WITH DILUTED ACID MAY PRODUCE MORE TRANSIENT EFFECTS FROM WHICH RECOVERY MAY BE COMPLETE.

CHRONIC EXPOSURE- REPEATED EXPOSURE MAY RESULT IN LACRIMATION AND CHRONIC CONJUNCTIVITIS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION:
SULFURIC ACID:
CORROSIVE:

ACUTE EXPOSURE- INGESTION MAY CAUSE BURNING PAIN IN THE MOUTH, THROAT, ESOPHAGUS AND ABDOMEN, A SOUR TASTE AND NAUSEA FOLLOWED BY VOMITING AND DIARRHEA OF CHARRED BLACK STOMACH CONTENTS. DEHYDRATION AND CARBONIZATION OF TISSUE MAY OCCUR WITH ESCHARS ON THE LIPS AND MOUTH. BROWNISH OR YELLOWISH STAINS MAY BE FOUND AROUND THE MOUTH, INTENSE THIRST, DIFFICULT SWALLOWING, ACIDEMIA, STOMATITIS, RAPID AND WEAK PULSE, SHALLOW BREATHING, SHOCK AND POSSIBLE CONVULSIONS MAY OCCUR. ALBUMIN, BLOOD AND CASTS IN URINE, ANURIA, ESOPHAGEAL AND DELAYED GASTRIC STENOSIS HAS BEEN REPORTED. POSSIBLE PERFORATION OF THE GASTROINTESTINAL TRACT MAY RESULT IN PERITONITIS.

CHRONIC EXPOSURE- NO DATA AVAILABLE.

FIRST AID- DO NOT USE GASTRIC LAVAGE OR EMESIS. DILUTE THE ACID IMMEDIATELY BY DRINKING LARGE QUANTITIES OF WATER OR MILK. IF VOMITING PERSISTS, ADMINISTER FLUIDS REPEATEDLY. INGESTED ACID MUST BE DILUTED APPROXIMATELY 100 FOLD TO RENDER IT HARMLESS TO TISSUES. MAINTAIN AIRWAY AND TREAT SHOCK. (DREISBACH, HANDBOOK OF POISONING, 12TH ED.). GET MEDICAL ATTENTION IMMEDIATELY. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION.

ANTIDOTE:
NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

REACTIVITY

REACTIVITY:
VIOLENT EXOTHERMIC REACTION WITH WATER.

INCOMPATIBILITIES:

SULFURIC ACID:

ACETALDEHYDE: VIOLENTLY POLYMERIZED BY CONCENTRATED ACID.

ACETIC ANHYDRIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

ACETONE + NITRIC ACID: VIOLENT DECOMPOSITION.

ACETONE + POTASSIUM DICHROMATE: IGNITION.

ACETONE CYANHYDRIN: PRESSURE INCREASE WITH POSSIBLE EXPLOSIVE RUPTURE OF VESSEL.

ACETONITRILE: VIOLENT EXOTHERM ON HEATING; SULFUR TRIOXIDE REDUCES INITIATION TEMPERATURE.

ACROLEIN: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

ACRYLONITRILE: VIGOROUS EXOTHERMIC POLYMERIZATION.

ALCOHOL: EXOTHERMIC REACTION AND CONTRACTION OF VOLUME.

ALCOHOLS AND HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.

ALLYL ALCOHOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

ALLYL CHLORIDE: VIOLENT POLYMERIZATION.

ALKYL NITRATES: MAY CAUSE VIOLENT REACTION.

2-AMINOETHANOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

AMMONIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.

AMMONIUM IRON(III) SULFATE DODECAHYDRATE: VIOLENT, EXOTHERMIC REACTION ON

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HEATING.

AMMONIUM TRIPERCHROMATE: FIRE OR EXPLOSION HAZARD.
ANILINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
BASES: VIOLENT REACTION.
BENZYL ALCOHOL: MAY DECOMPOSE EXPLOSIVELY AT ABOUT 180 C.
BROMATES + METALS: POSSIBLE IGNITION.
BROMINE PENTAFLUORIDE: VIOLENT REACTION WITH POSSIBLE IGNITION.
TERT-BUTYL-M-XYLENE: VIOLENT EXOTHERMIC REACTION WITHOUT AGITATION.
N-BUTYRALDEHYDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
CARBIDES: HAZARDOUS MIXTURE.
CESIUM ACETYLIDE: IGNITION ON CONTACT.
4-CHLORONITROBENZENE AND SULFUR TRIOXIDE: POSSIBLE EXPLOSIVE REACTION.
CHLORATES: ALL CHLORATES, WHEN BROUGHT IN CONTACT WITH SULFURIC ACID MAY GIVE OFF EXPLOSIVE CHLORINE DIOXIDE GAS. A VIOLENT EXPLOSION IS USUAL.
CHLORATES + METALS: POSSIBLE IGNITION.
CHLORINE TRIFLUORIDE: VIOLENT REACTION.
CHLOROSULFONIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
CHROMATES: FIRE AND EXPLOSION HAZARD.
COATINGS: ATTACKED.
COMBUSTIBLE MATERIALS (FINELY DIVIDED): MAY IGNITE.
COPPER: EVOLUTION OF SULFUR DIOXIDE.
CUPROUS NITRIDE: VIOLENT REACTION.
2-CYANO-4-NITROBENZENEDIAZONIUM HYDROGEN SULFATE: EXOTHERMIC REACTION.
2-CYANO-2-PROPANOL: VIOLENT REACTION WITH INCREASE IN PRESSURE.
CYCLOPENTADIENE: VIOLENT OR EXPLOSIVE REACTION.
CYCLOPENTANONE OXIME: VIOLENT REACTION.
1,3-DIAZIDOBENZENE: IGNITION FOLLOWED BY EXPLOSIVE REACTION.
DIETHYLAMINE: EXOTHERMIC REACTION.
DIISOBUTYLENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
DIMETHYLBENZYL CARBINOL + HYDROGEN PEROXIDE: EXPLODES.
DIMETHOXYANTHRAQUINONE: EXOTHERMIC REACTION ABOVE 150 C.
2,5-DINITRO-3-METHYLBENZOIC ACID + SODIUM AZIDE: EXPLOSIVE REACTION.
1,5-DINITRONAPHTHALENE + SULFUR: EXOTHERMIC REACTION.
EPICHLOROHYDRIN: VIOLENT REACTION.
ETHOXYLATED NONYLPHENOL: POSSIBLE IGNITION.
ETHANOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
ETHYLENE CYANOHYDRIN: VIOLENT REACTION.
ETHYLENE DIAMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
ETHYLENE GLYCOL: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
ETHYLENIMINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
FULMINATES: EXTREMELY HAZARDOUS MIXTURE.
HEXALITHIUM DISILICIDE: INCANDESCENT REACTION.
HYDROCHLORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
HYDROGEN PEROXIDE (>50%): EXPLOSIVE REACTION AFTER EVAPORATION.
HYDROFLUORIC ACID: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
INDANE + NITRIC ACID: POSSIBLE EXPLOSION.
IODINE HEPTAFLUORIDE: THE ACID BECOMES EFFERVESCENT.
IRON: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
ISOPRENE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
LITHIUM SILICIDE: INCANDESCENT REACTION.
MERCURY NITRIDE: EXPLOSION ON CONTACT.
MESITYL OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
METALS: MAY LIBERATE FLAMMABLE HYDROGEN GAS.
METALS (POWDERED): EXTREMELY HAZARDOUS MIXTURE.
METAL ACETYLIDES: IGNITION REACTION.
METAL CHLORATES: VIOLENT EXPLOSION UNLESS PROPERLY COOLED.
METAL PERCHLORATES: FORMATION OF EXPLOSIVE PERCHLORIC ACID.
4-METHYLPYRIDINE: EXOTHERMIC REACTION.
NITRAMIDE: MAY DECOMPOSE EXPLOSIVELY ON CONTACT.
NITRATES: INCOMPATIBLE.
NITRIC ACID + GLYCERIDES: EXPLOSION.
NITRIC ACID + ORGANIC MATERIAL: MAY CAUSE VIOLENT REACTION.
NITRIC ACID + TOLUENE: POSSIBLE VIOLENT REACTION OR EXPLOSION.
NITROARYL BASES AND DERIVATIVES: MAY CAUSE VIOLENT REACTION OR EXPLOSION.
NITROBENZENE: EXOTHERMIC REACTION AT ELEVATED TEMPERATURES.
3-NITROBENZENESULFONIC ACID: EXOTHERMIC REACTION.
NITROMETHANE: FORMATION OF EXPLOSIVE MIXTURE.
N-NITROMETHYLAMINE: EXPLOSIVE DECOMPOSITION.
4-NITROTOLUENE: EXPLOSIVE AT 80 C.
ORGANICS: VIOLENT EXOTHERMIC REACTION.
PENTASILVER TRIHYDROXYDIAMIDOPHOSPHATE: EXPLOSION ON CONTACT.
PERCHLORATES: POSSIBLE EXPLOSION.
PERCHLORIC ACID: FORMATION OF DANGEROUS ANHYDROUS PERCHLORIC ACID.
PERMANGANATES: FORMATION OF PERMANGANIC ACID.
PERMANGANATES + BENZENE: POSSIBLE EXPLOSION.
1-PHENYL-2-METHYL-PROPYL ALCOHOL + HYDROGEN PEROXIDE: POSSIBLE EXPLOSION.
PHOSPHORUS (WHITE OR YELLOW): IGNITION IN CONTACT WITH BOILING ACID.
PHOSPHORUS ISOCYANATE: VIOLENT REACTION.
PHOSPHORUS TRIOXIDE: VIOLENT OXIDATION WITH POSSIBLE IGNITION.
PICRATES: EXTREMELY HAZARDOUS MIXTURE.
PLASTICS: ATTACKED.
POLYSILYLENE: EXPLOSION ON CONTACT.
POTASSIUM: EXPLOSIVE INTERACTION.
POTASSIUM TERT-BUTOXIDE: IGNITION.
POTASSIUM CHLORATE: POSSIBLE FIRE AND EXPLOSION.
POTASSIUM PERMANGANATE: POSSIBLE EXPLOSION IN THE PRESENCE OF MOISTURE.
POTASSIUM PERMANGANATE + POTASSIUM CHLORIDE: VIOLENT EXPLOSION.
PROPIOLACTONE (BETA): TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
PROPYLENE OXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
3-PROPYNOL: POSSIBLE EXPLOSION UNLESS ADEQUATELY COOLED.

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PYRIDINE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
REDUCING AGENTS: REACTS.
RUBBER: ATTACKED.
RUBIDIUM ACETYLIDE: IGNITION ON CONTACT.
SILVER PERMANGANATE (MOIST): EXPLOSIVE REACTION.
SILVER PEROXOCHROMATE: EXPLOSIVE REACTION.
SODIUM: EXPLOSIVE REACTION WITH AQUEOUS ACID.
SODIUM CARBONATE: VIOLENT REACTION.
SODIUM CHLORATE: POSSIBLE FIRE OR EXPLOSION.
SODIUM HYDROXIDE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
SODIUM TETRAHYDROBORATE: VIOLENT, EXOTHERMIC REACTION.
SODIUM THIOCYANATE: VIOLENT EXOTHERMIC WITH EVOLUTION OF CARBONYL SULFIDE.
STEEL: POSSIBLE EXPLOSION DUE TO HYDROGEN GAS FROM THE ACID-METAL REACTION.
STYRENE MONOMER: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
TETRAMETHYLBENZENES: VIOLENT REACTION IN CLOSED CONTAINERS.
1,2,4,5-TETRAZINE: VIOLENT DECOMPOSITION ON CONTACT.
THALLIUM(I) AZIDIDITHIOCARBONATE: MAY EXPLODE ON CONTACT.
1,3,5-TRINITROSOHEXAHYDRO-1,3,5-TRIAZINE: EXPLOSIVE DECOMPOSITION ON CONTACT.
VINYL ACETATE: TEMPERATURE AND PRESSURE INCREASE IN CLOSED CONTAINER.
ZINC CHLORATE: LIKELY TO CAUSE FIRES AND EXPLOSIONS.
ZINC IODIDE: VIOLENT INTERACTION.

DECOMPOSITION:

THERMAL DECOMPOSITION MAY RELEASE TOXIC OXIDES OF SULFUR.

POLYMERIZATION:

HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.

----- STORAGE AND DISPOSAL

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

STORAGE

PROTECT AGAINST PHYSICAL DAMAGE AND WATER. SEPARATE FROM CARBIDES, CHLORATES, FULMINATES, NITRATES, PICRATES, POWDERED METALS, AND COMBUSTIBLE MATERIALS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

THRESHOLD PLANNING QUANTITY (TPQ):
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

DISPOSAL

DISPOSAL MUST BE IN ACCORDANCE WITH STANDARDS APPLICABLE TO GENERATORS OF HAZARDOUS WASTE, 40 CFR 262. EPA HAZARDOUS WASTE NUMBER 0002.

100 POUND CERCLA SECTION 103 REPORTABLE QUANTITY.

CONDITIONS TO AVOID

MAY IGNITE OTHER COMBUSTIBLE MATERIALS (WOOD, PAPER, OIL, ETC.). VIOLENT REACTION WITH WATER. FLAMMABLE. POISONOUS GASES MAY ACCUMULATE IN CONFINED SPACES. RUNOFF TO SEWER MAY CREATE FIRE OR EXPLOSION HAZARD.

SPILL AND LEAK PROCEDURES

SOIL SPILL:

DIG HOLDING AREA SUCH AS LAGOON, POND OR PIT FOR CONTAINMENT.

DIKE FLOW OF SPILLED MATERIAL USING SOIL OR SANDBAGS OR FOAMED BARRIERS SUCH AS POLYURETHANE OR CONCRETE.

USE CEMENT POWDER OR FLY ASH TO ABSORB LIQUID MASS.

NEUTRALIZE SPILL WITH SLAKED LIME, SODIUM BICARBONATE OR CRUSHED LIMESTONE.

AIR SPILL:

APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT AND LATER DISPOSAL.

WATER SPILL:

NEUTRALIZE WITH AGRICULTURAL LIME, SLAKED LIME, CRUSHED LIMESTONE, OR SODIUM BICARBONATE.

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OCCUPATIONAL SPILL:

KEEP COMBUSTIBLES (WOOD, PAPER, OIL, ETC.) AWAY FROM SPILLED MATERIAL. DO NOT TOUCH SPILLED MATERIAL. DO NOT GET WATER INSIDE CONTAINER. STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS. DO NOT PUT WATER ON LEAK OR SPILL AREA. CLEAN UP ONLY UNDER THE SUPERVISION OF AN EXPERT. DIKE SPILL FOR LATER DISPOSAL. DO NOT APPLY WATER UNLESS DIRECTED TO DO SO. KEEP UNNECESSARY PEOPLE AWAY. ISOLATE HAZARD AREA AND DENY ENTRY. VENTILATE CLOSED SPACES BEFORE ENTERING.

REPORTABLE QUANTITY (RQ): 1000 POUNDS

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

PROTECTIVE EQUIPMENT

VENTILATION:

PROCESS ENCLOSURE RECOMMENDED TO MEET PUBLISHED EXPOSURE LIMITS.

RESPIRATOR:

THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29CFR1910 SUBPART Z. THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

SULFURIC ACID:

25 MG/M3- ANY POWERED AIR-PURIFYING RESPIRATOR WITH AN ACID GAS CARTRIDGE(S) AND HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SUPPLIED-AIR RESPIRATOR OPERATED IN A CONTINUOUS FLOW MODE.

50 MG/M3- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH A FULL FACEPIECE AND ACID GAS CARTRIDGE(S) IN COMBINATION WITH A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY SELF-CONTAINED BREATHING APPARATUS WITH A FULL FACEPIECE.
ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE.
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.

80 MG/M3- ANY SUPPLIED-AIR RESPIRATOR WITH A FULL FACEPIECE AND OPERATED IN A PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED ACID GAS CANISTER HAVING A HIGH-EFFICIENCY PARTICULATE FILTER.
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE DEMAND OR OTHER POSITIVE PRESSURE MODE.

SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

CLOTHING:

WEAR APPROPRIATE PROTECTIVE CLOTHING TO AVOID ANY POSSIBILITY OF SKIN CONTACT WITH LIQUIDS CONTAINING MORE THAN 1% SULFURIC ACID. AVOID REPEATED OR PROLONGED SKIN CONTACT WITH LIQUIDS CONTAINING 1% OR LESS SULFURIC ACID.

GLOVES:

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS SUBSTANCE.

EYE PROTECTION:

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

EMERGENCY WASH FACILITIES:

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

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-ADDITIONAL INFORMATION-

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Chemtrec # (800) 424-9300
National Response Center # (800) 424-8802

**MATERIAL
SAFETY DATA
SHEET**

T4940 -02
Effective: 09/05/86

Trichloroethylene

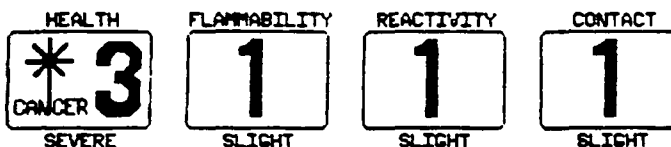
Page: 1
Issued: 09/05/86

SECTION I - PRODUCT IDENTIFICATION

Product Name: Trichloroethylene
Formula: C_2HCl_3
Formula Wt: 131.40
CAS No.: 00079-01-6
NIOSH/RTECS No.: KX4550000
Common Synonyms: Trichloroethene; Ethinyl Trichloride; Acetylene Trichloride; TCE
Product Codes: 5376, 9458, 9454, 9455, 9464, 9473

PRECAUTIONARY LABELLING

BAKER SAF-T-DATATM System



Laboratory Protective Equipment



Precautionary Label Statements

WARNING!

HARMFUL IF SWALLOWED OR INHALED
CAUSES IRRITATION

NOTE: THIS MATERIAL OR ITS VAPORS IN CONTACT WITH FLAMES OR HOT GLOWING SURFACES MAY FORM CORROSIVE ACID FUMES.

NOTE: REPORTED AS CAUSING CANCER IN LABORATORY ANIMALS. EXERCISE DUE CARE. Avoid contact with eyes, skin, clothing. Do not breathe vapor. Keep in tightly closed container. Use with adequate ventilation. Wash thoroughly after handling.

SECTION II - HAZARDOUS COMPONENTS

Component	%	CAS No.
Trichloroethylene	90-100	79-01-6



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Trichloroethylene

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SECTION III - PHYSICAL DATA

Boiling Point: 86°C (187°F)

Vapor Pressure(mmHg): 58

Melting Point: -73°C (-99°F)

Vapor Density(air=1): 4.53

Specific Gravity: 1.47
(H₂O=1)

Evaporation Rate: N/A
(Butyl Acetate=1)

Solubility(H₂O): Negligible (less than 0.1 %) % Volatiles by Volume: 100

Appearance & Odor: Liquid with chloroform odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

NFPA 704M Rating: 2-1-0

Flammable Limits: Upper - 10.5 % Lower - 8 %

Fire Extinguishing Media

Use extinguishing media appropriate for surrounding fire.

Special Fire-Fighting Procedures

Firefighters should wear proper protective equipment and self-contained (positive pressure if available) breathing apparatus with full facepiece. Move exposed containers from fire area if it can be done without risk. Use water to keep fire-exposed containers cool.

Unusual Fire & Explosion Hazards

Closed containers exposed to heat may explode.

Toxic Gases Produced

hydrogen chloride

SECTION V - HEALTH HAZARD DATA

Some experiments with test animals indicated that this substance may be anticipated to be a carcinogen.

Threshold Limit Value (TLV/TWA): 270 mg/m³ (50 ppm)

Short-Term Exposure Limit (STEL): 1080 mg/m³ (200 ppm)

Permissible Exposure Limit (PEL): mg/m³ (100 ppm)

Toxicity: LD₅₀ (oral-rat)(mg/kg) - 4920

LD₅₀ (ipr-mouse)(mg/kg) - 3000

Continued on Page: 3



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SECTION U - HEALTH HAZARD DATA (Continued)

Carcinogenicity: NTP: No IARC: No Z List: No OSHA reg: No

Effects of Overexposure

Inhalation of vapors may cause nausea, vomiting, headache, or loss of consciousness.

Ingestion may cause nausea, vomiting and loss of consciousness.

Medical Conditions Generally Aggravated By Exposure

None Identified

Routes Of Entry

inhalation, ingestion, eye contact, skin contact

Emergency and First Aid Procedures

CALL A PHYSICIAN.

If swallowed, if conscious, immediately induce vomiting.

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Flush skin with water.

Acceptable maximum peak above the acceptance ceiling concentration for an eight-hour shift = 300 ppm for 5 minutes in any 2 hours. (PEL)

Ceiling = 200 ppm.

SECTION VI - REACTIVITY DATA

Stability: Stable Hazardous Polymerization: Will not occur

Conditions to Avoid: heat, light, sources of ignition, flame

Incompatibles: chemically active metals, strong bases

Decomposition Products: hydrogen chloride

SECTION VII - SPILL AND DISPOSAL PROCEDURES

Steps to be taken in the event of a spill or discharge

Wear self-contained breathing apparatus and full protective clothing.

Stop leak if you can do so without risk. Use water spray to reduce vapors.

Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush spill area with water.

Disposal Procedure

Dispose in accordance with all applicable federal, state, and local environmental regulations.

EPA Hazardous Waste Number:

U228 (Toxic Waste)

Continued on Page: 4



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T4940 -02
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Trichloroethylene

Page: 4
Issued: 09/05/86

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

Ventilation: Use general or local exhaust ventilation to meet TLV requirements.

Respiratory Protection: Respiratory protection required if airborne concentration exceeds TLV. At concentrations up to 1000 ppm, a chemical cartridge respirator with organic vapor cartridge is recommended. Above this level, a self-contained breathing apparatus is recommended.

Eye/Skin Protection: Safety goggles and face shield, uniform, protective suit, neoprene gloves are recommended.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATATM Storage Color Code: Blue

Special Precautions

Keep container tightly closed. Store in secure poison area.

SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

DOMESTIC (D.O.T.)

Proper Shipping Name	Trichloroethylene (air only)
Hazard Class	ORM-A
UN/NA	UN1710
Labels	NONE
Reportable Quantity	1000 LBS.

INTERNATIONAL (I.M.O.)

Proper Shipping Name	Trichloroethylene
Hazard Class	6.1
UN/NA	UN1710
Labels	HAZARDOUS - STOW AWAY FROM FOOD STUFFS

N/A = Not Applicable or Not Available

The information published in this Material Safety Data Sheet has been compiled from our experience and data presented in various technical publications. It is the user's responsibility to determine the suitability of this information for the adoption of necessary safety precautions. We reserve the right to revise Material Safety Data Sheets periodically as new information becomes available.

APPENDIX B

PERSONAL AIR MONITORING
SAMPLING AND ANALYSIS METHODS

U.S. Department of Labor
Occupational Safety and Health Administration

Directorate of Compliance Programs
Office of Health Compliance Assistance



OSHA

Industrial Hygiene Technical Manual

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PUBLISHER'S NOTE

This publication was prepared by the U.S. Department of Labor, Occupational Safety and Health Administration, for use within OSHA. Government Institutes determined that it contained information of interest to parties outside OSHA so we undertook on our own to reproduce this material in order to serve those interested.

The Industrial Hygiene Technical Manual was prepared by OSHA's Office of Health Compliance Assistance for all OSHA personnel in the National, Regional, Area and District Offices and is updated through April 1988. The purpose of the Technical Manual is to set forth current OSHA industrial hygiene practices and procedures. Current OSHA enforcement and compliance policies are contained in the OSHA Field Operations Manual.

In October 1987, the Office of Health Compliance Assistance of OSHA established **Appendix A** of the Industrial Hygiene Technical Manual as a separate, free standing document, the **Chemical Information Manual**. This new manual can be obtained from Government Institutes by contacting us at the address below.

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MAR 30 1984

CHAPTER I

FIELD CALIBRATION PROCEDURES

A. General.

1. Definition. Calibration may be defined as determining the true values of the scale readings of a measuring instrument.
2. Purpose. Proper calibration is essential in order to determine accurately employee exposure, source of exposure, or the effectiveness of engineering controls. The meter indication must be correctly interpreted to determine the volume of air sampled and the amount of contaminant in the sample, in the case of chemical exposure, and the level of exposure to noise.

B. Batteries.

1. Carbon Zinc Batteries. Always remove carbon zinc batteries from the instrument when not in use.
2. Rechargeable Battery Packs. Check the batteries under load before use. The following list gives the fully-charged voltage of several rechargeable battery packs:

MSA Model G Pump	6.4 to 6.8 volts (below 5.5 volts-replace)
Bendix 44 Pump	3.7 to 4.0 volts
DuPont P-125 A & P-200 Pumps	4.0 to 5.2 volts

3. Ni-Cad Batteries.

- a. It is undesirable to discharge a multi-celled Ni-Cad battery pack to voltage levels which are 70 percent or less of its rated voltage--doing so will drive a reverse current through some of the cells which can permanently damage them. When the voltage of the battery pack drops to 70 percent of its rated value, it is considered depleted and should be recharged.

- ### Figure 1-1

MAR 30 1984

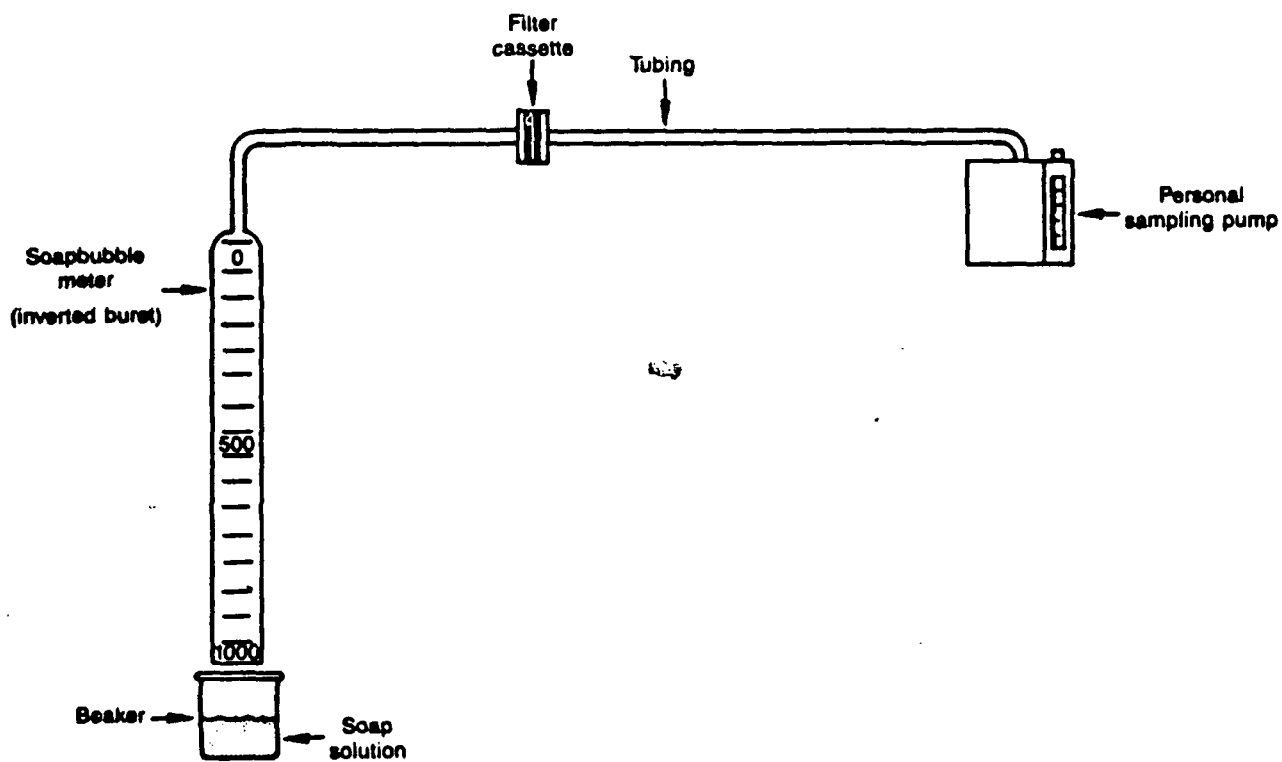
- C. Flow Calibration of Personal Sampling Pumps. When a sampling train requires an unusual combination of sampling media (e.g., glass fiber filter preceeding impinger), the same media/devices should be in line during calibration.
1. Total Dust and Metal Fume. Calibrate personal sampling pumps before and after each day of sampling, using either the bubble meter method or the precision rotameter method.
- a. Bubble Meter Method.
- (1) Allow the pump to run 5 minutes prior to voltage check and calibration. Refer to paragraph B.2. of this chapter for fully charged voltage of several rechargeable battery packs.
 - (2) Assemble the polystyrene cassette filter holder, as shown in Figure III-1 (page III-5), using the appropriate filter for the sampling method. If a cassette adaptor is used, care should be taken to ensure that it does not come in contact with the back-up pad.
- NOTE: When calibrating with a bubble meter, the use of cassette adaptors can cause moderate to severe pressure drop in the sampling train, which will affect the calibration result. If adaptors are used for sampling, then they should be used when calibrating.
- (3) Connect the collection device, tubing, pump and calibration apparatus as shown in Figure I-2 (page I-5).
 - (4) A visual inspection should be made of all Tygon tubing connections.
 - (5) Wet the inside of a 1-liter buret with a soap solution.
 - (6) Turn on the pump and adjust the pump rotameter to the appropriate flow rate setting.
 - (7) Momentarily submerge the opening of the buret in order to capture a film of soap.

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- (8) Draw two or three bubbles up the buret in order to ensure that the bubbles will complete their run.
 - (9) Visually capture a single bubble and time the bubble from 0 to 1000 ml for high flow pumps or 0 to 100 ml for low flow pumps.
 - (10) The timing accuracy must be within ± 1 second of the time corresponding to the desired flow rate.
 - (11) If the time is not within the range of accuracy, adjust the flow rate and repeat steps (9) and (10) until the correct flow rate is achieved. Perform steps (9) and (10) at least twice, in any event.
 - (12) While the pump is still running, mark the pump or record on the OSHA-91 the position of the center of the float in the pump rotameter as a reference.
 - (13) Repeat the procedures described above for all pumps to be used for sampling. The same cassette and filter may be used for all calibrations involving the same sampling method.
- b. Precision Rotameter Method. The precision rotameter is a secondary calibration device. If it is to be used in place of a primary device such as a bubble meter, care must be taken to ensure that any introduced error will be minimal.
- (1) Replacing the Bubble Meter. The precision rotameter may be used for calibrating the personal sampling pump in lieu of a bubble meter provided it is:
 - (a) Calibrated with a bubble meter as described in C.1.b.(2) below, on a regular basis (at least quarterly).
 - (b) Disassembled, cleaned as necessary, and recalibrated. It should be used with care to avoid dirt and dust contamination which may affect the flow.

Figure I-2

Calibration Setup for Personal Sampling Pump with Filter Cassette



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- (c) Not used at substantially different temperature and/or pressure from those conditions present when the rotameter was calibrated using the primary source (i.e., bubble meter). (See C.1.b.(2) below.)
 - (d) Used such that pressure drop across it is minimal. (The precision rotameter should not be used with a ball adjustment valve accessory, nor with any other restriction that would cause substantial pressure drop.)
- (2) Using a Bubble Meter. When sampling with a filter, it is desirable to be able to determine the flow over the complete pump range, so that if the flow drops off during the sampling period, the flow rate is still known and the sample does not need to be disregarded.
- (a) Set up the calibration apparatus as shown in Figure I-2, page I-5.
 - 1 Without the precision rotameter in line, connect the pump to the bubble meter and adjust the pump flow control to obtain the maximum flow rate.
 - 2 Determine the exact flow rate by timing a bubble traveling 1 liter. Record the flow.
 - 3 Disconnect the bubble meter connection and attach the precision rotameter. Record the precision rotameter reading.
 - 4 Repeat steps 1 through 3 for at least five different flow rates.
 - 5 Plot a curve of actual flow rate vs. precision rotameter readings.
 - 6 Recalibrate the precision rotameter according to steps 1 through 4 after cleaning, at least quarterly, or more

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frequently if a change in flow characteristics of the rotameter is suspected.

- (b) After the precision rotameter has been calibrated, the pump may be set to the desired flow rate by simply putting it in line with the precision rotameter. The pump flow rate may then be adjusted until the desired precision rotameter reading, corresponding to the desired flow rate determined during calibration, is obtained. It is not necessary to recalibrate the precision rotameter for each pump.
- (c) In order to determine if the desired flow rate is being maintained during sampling, one of the following two methods may be used:
 - 1 After the flow rate is initially set using the precision rotameter, observe and note the pump rotameter reading. On subsequent checks, if the flow rate has decreased, a visual observation should be made. If excessive dust is not observed, check the voltage. If the voltage for the MSA pump is below 5.5, replace the pump. The flow rate should not be adjusted. If the filter is excessively dusty, replace the filter instead of adjusting the flow rate.
 - 2 The precision rotameter can be plugged into the cassette, and knowing the desired precision rotameter setting, the pump flow rate can be adjusted.
 - 3 Note any adjustments on the OSHA-91.
- (d) If the pump cannot be readjusted to the initial flow rate, the flow rate may be determined using the precision rotameter.

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Office of Health Compliance Assistance

- (3) Unusual Conditions. If barometric or temperature conditions at the sampling site are substantially different than at the calibration site, i.e., approximately ± 40 mm Hg (1500 feet elevation) or $\pm 20^\circ$ F change, it is necessary to calibrate the precision rotameter at the sampling site where the same conditions are present, or apply the correction factors listed in Figures II-5, II-6, II-7 and II-8 (pages II-18 through II-22).

2. Respirable Dust and Open Face Filters.

- a. For respirable dust sampling using a cyclone or sampling using an open face filter, set up the calibration apparatus as found in Figure I-3, page I-9.
- b. Replace the filter cassette with a 1-liter jar containing the cassette holder assembly and cyclone or the open face filter cassette. The jar is provided with a special fluid transfer closure.
- c. Connect the tubing from the bubble meter to the inlet of the jar.
- d. Connect the tubing from the outlet of the holder assembly with cyclone or from the filter cassette to the outlet of the jar and then to the sampling pump.
- e. Calibrate the pump according to paragraph C.1.a. or C.1.b. of this chapter with an appropriate flow rate. The timing accuracy must be within ± 1 second of the time corresponding to the desired flow rate. A flow rate of 1.7 lpm will correspond to the bubble traveling up the 1000 ml burette within 35.3 ± 1 second.

3. Cotton Dust Sampling Equipment. (Reserved)

NIOSH MANUAL OF ANALYTICAL METHODS

THIRD EDITION

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VOLUME 1 *And Volume II*

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health
Division of Physical Sciences and Engineering
Cincinnati, Ohio

February, 1984

DEFINITION: Total aerosol mass

NUISANCE DUST, TOTAL

METHOD: 0500
ISSUED: 2/15/84

OSHA: 15 mg/m³
NIOSH: no standard
ACGIH: 10 mg/m³, total dust less than
1% quartz

PROPERTIES: quartz less than 1% [1]

SYNONYMS: boron oxide (CAS #1303-86-2) and nuisance dusts [1] including alumina (CAS #1344-28-1), calcium carbonate (CAS #1317-65-3), cellulose (paper fiber; CAS #9004-34-6), glycerin mist (CAS #56-81-5), limestone (CAS #1317-65-3), etc.

SAMPLING	MEASUREMENT
SAMPLER: FILTER (tared 37-mm, 5-µm PVC filter)	! TECHNIQUE: GRAVIMETRIC (FILTER WEIGHT)
FLOW RATE: 1.5 to 2 L/min	! ANALYTE: airborne particulate material
VOL-MIN: 25 L @ 15 mg/m ³ -MAX: 133 L @ 15 mg/m ³	! BALANCE: 0.01 mg sensitivity or better; use same ! balance before and after sample ! collection
SHIPMENT: routine	! CALIBRATION: National Bureau of Standards ! Class M weights
SAMPLE STABILITY: indefinitely	! RANGE: 0.3 to 2 mg per sample
BLANKS: 2 field blanks per 10 samples	! ESTIMATED LOD: 0.2 mg per sample
BULK SAMPLE: none required	! PRECISION: 0.08 mg per sample [3]
ACCURACY	!
RANGE STUDIED: 8 to 28 mg/m ³	!
BIAS: not significant	!
OVERALL PRECISION (s _p): 0.056 [2]	!

APPLICABILITY: The working range is 3 to 20 mg/m³ for a 100-L air sample. This method is nonspecific and determines the total dust concentration to which a worker is exposed. It may be applied, e.g., to gravimetric determination of fibrous glass [4] in addition to the other ACGIH nuisance dusts [1].

INTERFERENCES: Organic and volatile particulate matter may be removed by dry ashing [4].

OTHER METHODS: This method is similar to the criteria document method for fibrous glass [4] and Method 5000 for carbon black. This method replaces Method 5349 [5]. Impingers and direct-reading instruments may be used to collect total dust samples, but these have limitations for personal sampling.

EQUIPMENT:

1. Environmental chamber at constant temperature and humidity (e.g., $20\text{ }^{\circ}\text{C} \pm 0.3\text{ }^{\circ}\text{C}$ and $50\% \pm 5\% \text{ RH}$).
2. Sampler: 37-mm PVC, 2- to 5- μm pore size membrane or equivalent hydrophobic filter and cellulose supporting pad in 37-mm cassette filter holder.
3. Personal sampling pump, 1.5 to 2 L/min, with flexible connecting tubing.
4. Microbalance, capable of weighing to 0.01 mg.
5. Vacuum desiccator.
6. Static neutralizer: e.g., Po-210; replace nine months after the production date.

SPECIAL PRECAUTIONS: None.

PREPARATION OF FILTERS BEFORE SAMPLING:

1. Dry filters and backup pads under vacuum in the vacuum desiccator for at least 15 min.
2. Release the vacuum, remove the desiccator cover and equilibrate the filters in the environmental chamber for at least 1 hr.
3. Number the backup pads with a ballpoint pen and place them, numbered side down, in filter cassette bottom sections.
4. Weigh the filters in the environmental chamber. Record the filter tare weight, W_1 (mg).
 - a. Zero the balance before each weighing.
 - b. Handle the filter with forceps (nylon forceps if further analyses will be done).
 - c. Pass the filter over an antistatic radiation source. Repeat this step if filter does not release easily from the forceps or if filter attracts balance pan. Static electricity can cause erroneous weight readings.
5. Place the weighed filters on top of the backup pads in the filter cassette bottom sections and allow to stand an additional 8 to 16 hrs in the environmental chamber.
6. Reweigh the filters. If this tare weight differs by more than 0.01 mg from the first tare weight obtained in step 4 above, discard the filter.

NOTE: Insert a rod through the outlet hole of the filter cassette bottom section to raise the backup pad and filter so that the filter can be grasped with forceps.
7. Assemble the filter in the filter cassettes and close firmly so that leakage around the filter will not occur. Place a plug in each opening of the filter cassette. Place a cellulose shrink band around the filter cassette, allow to dry and mark with the same number as the backup pad.

SAMPLING:

8. Calibrate each personal sampling pump with a representative sampler in line.
9. Sample at 1.5 to 2 L/min. Do not exceed a total filter loading of approximately 2 mg total dust.

SAMPLE PREPARATION:

10. Wipe dust from the external surface of the filter cassette with a moist paper towel to minimize contamination. Discard the paper towel.
11. Remove the top and bottom plugs from the filter cassette. Place the filter cassettes in a vacuum desiccator under vacuum for at least 15 min, followed by equilibration for at least 1 hr in the environmental chamber.
12. Remove the cassette band, pry open the cassette and remove the filter. Handle the filters very gently by the edge to avoid loss of dust.

NOTE: If the filter sticks to the underside of the cassette top, very gently lift away by using the dull side of a scalpel blade. This must be done carefully or the filter will tear.

CALIBRATION AND QUALITY CONTROL:

13. Zero the microbalance before all weighings. Use the same microbalance for weighing filters before and after sample collection. Maintain and calibrate the balance with National Bureau of Standards Class M weights.
14. Take two to four replicate samples for every batch of field samples for quality assurance on the sampling procedures. The set of replicate samples should be exposed to the same dust environment, either in a laboratory dust chamber [6] or in the field. The quality control samples must be taken with the same equipment, procedures and personnel used in the routine field samples. The relative standard deviation calculated from these replicates should be recorded on control charts and action taken when the precision is out of control.

MEASUREMENT:

15. Weigh each filter, including field blanks. Record this post-sampling weight, W_2 (mg), beside its corresponding tare weight. Record anything remarkable about a filter (e.g., overload, leakage, wet, torn, etc.).

CALCULATIONS:

16. Calculate the concentration of total nuisance dust, C (mg/m^3), in the air volume sampled, V (L):

$$C = \frac{(W_2 - W_1) + B}{V} \cdot 10^3, \text{ mg}/\text{m}^3$$

where: W_1 = tare weight of filter before sampling (mg)

W_2 = post-sampling weight of sample-containing filter (mg)

B = mean change in field blank filter weights between tare and post-sampling (mg)
(+ or -).

EVALUATION OF METHOD:

Lab testing with blank filters and generated atmospheres of carbon black was done at 8 to 28 mg/m^3 [2,6]. Precision and accuracy data are given on page 0500-1.

REFERENCES:

- [1] TLVs - Threshold Limit Values for 1983-84, Appendix D, ACGIH, Cincinnati, OH (1983).
- [2] This Manual, Method 5000.
- [3] Unpublished data from Non-textile Cotton Study, NIOSH/DRDS/EIB.
- [4] NIOSH Criteria for a Recommended Standard ... Occupational Exposure to Fibrous Glass, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-152, 119-142 (1977).
- [5] NIOSH Manual of Analytical Methods, 2nd ed., V. 3, S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-157-C (1977).
- [6] Documentation of the NIOSH Validation Tests, S262 and S349, U.S. Department of Health, Education, and Welfare, Publ. (NIOSH) 77-185 (1977).

METHOD WRITTEN BY: Kathy Moring, Jerry Clere, and Frank Hearl, P.E., NIOSH/DRDS.

FORMULA: mixture: $C_{12}H_{10-x}Cl_x$
[where $x = 1$ to 10]
M.W.: ca. 258 (42% Cl ; $C_{12}H_7Cl_2$);
ca. 326 (54% Cl ; $C_{12}H_5Cl_5$)

POLYCHLOROBIPHENYLS

METHOD: 5503

ISSUED: 2/15/84

REVISION #1: 8/15/87

OSHA: 1 mg/m³ (42% Cl);
0.5 mg/m³ (54% Cl)
NIOSH: 0.001 mg/m³ [1,2]
ACGIH: 1 mg/m³ (42% Cl); STEL 2 mg/m³
0.5 mg/m³ (54% Cl); STEL 1 mg/m³
(skin)

PROPERTIES: 42% Cl: BP 325 to 366 °C; MP -19 °C;
d 1.38 g/mL @ 25 °C;
VP 0.01 Pa (8×10^{-5} mm Hg;
1 mg/m³) @ 20 °C [3]
54% Cl: BP 365 to 390 °C; MP 10 °C;
d 1.54 g/mL @ 25 °C;
VP 0.0004 Pa (3×10^{-6} mm Hg;
0.05 mg/m³) @ 20 °C [3,4]

SYNONYMS: PCB; CAS #1336-36-3; 1,1'-biphenyl chloro (CAS #27323-18-8); chlorodiphenyl, 42% Cl (Aroclor 1242; CAS #53469-21-9), and 54% Cl (Aroclor 1254; CAS #11097-69-1)

SAMPLING	MEASUREMENT
SAMPLER: FILTER + SOLID SORBENT (13-mm glass fiber + Florisil, 100 mg/50 mg)	! TECHNIQUE: GAS CHROMATOGRAPHY, ECD (⁶³ Ni) ! ! ANALYTE: polychlorobiphenyls !
FLOW RATE: 0.05 to 0.2 L/min or less	! DESORPTION: filter + front section, 5 mL hexane; ! back section, 2 mL hexane !
VOL-MIN: 1 L @ 0.5 mg/m ³ -MAX: 50 L	! INJECTION VOLUME: 4 µL with 1-µL backflush !
SHIPMENT: transfer filters to glass vials after sampling	! TEMPERATURE-INJECTION: 250 - 300 °C ! -DETECTOR: 300 - 325 °C ! -COLUMN: 180 °C !
SAMPLE STABILITY: unknown for filters; 2 months for Florisil tubes [5]	! CARRIER GAS: N ₂ , 40 mL/min !
BLANKS: 10% of samples	! COLUMN: glass, 1.8 m x 2 mm ID, 1.5% OV-17/1.95% ! QF-1 on 80/100 mesh Chromosorb WHP !
ACCURACY	! CALIBRATION: standard PCB mixture in hexane !
RANGE STUDIED: not studied	! RANGE: 0.4 to 4 µg per sample [6] !
BIAS: none identified	! ESTIMATED LOD: 0.03 µg per sample [6] !
OVERALL PRECISION (s _r): not evaluated	! PRECISION (s _r): 0.044 [5] !
APPLICABILITY: The working range is 0.01 to 10 mg/m ³ for a 40-L air sample [5]. With modifications, surface wipe samples may be analyzed [7,8].	
INTERFERENCES: Chlorinated pesticides, such as DDT and DDE, may interfere with quantitation of PCB. Sulfur-containing compounds in petroleum products also interfere [9].	
OTHER METHODS: This method revises Methods S120 [10], 5503 (dated 2/15/84), and P&CAM 244 [5]. Methods S121 [11] and P&CAM 253 [12] for PCB have not been revised.	

REAGENTS:

1. Hexane, pesticide quality.
2. Florisil, 30/48 mesh sieved from 30/60 mesh. After sieving, dry at 105 °C for 45 min. Mix the cooled Florisil with 3% (w/w) distilled water.
3. Nitrogen, purified.
4. Stock standard solution of the PCB in methanol or isooctane (commercially available).*

*See SPECIAL PRECAUTIONS.

EQUIPMENT:

1. Sampler: 13-mm glass fiber filter without binders in a Swinnex cassette (Cat. No. SX 0001300, Millipore Corp.) followed by a glass tube, 7 cm long, 6 mm OD, 4 mm ID containing two sections of 30/48 mesh deactivated Florisil. The front section is preceded by glass wool and contains 100 mg and the backup section contains 50 mg; urethane foam between sections and behind the backup section. Join the cassette and Florisil tube with PVC tubing, 3/8" L x 9/32" OD x 5/32" ID, on the outlet of the cassette and with another piece of PVC tubing, 3/4" L x 5/16" OD x 3/16" ID, complete the union.
2. Personal sampling pump, 0.05 to 0.2 L/min, with flexible connecting tubing.
3. Tweezers.
4. Vials, glass, 4- and 7-mL, with aluminum or PTFE-lined caps.
5. Gas chromatograph, electron capture detection (⁶³Ni), integrator and column (page 5503-1).
6. Volumetric flasks, 10-mL and other convenient sizes for preparing standards.
7. Syringe, 10-μL.

SPECIAL PRECAUTIONS: Avoid prolonged or repeated contact of skin with PCB and prolonged or repeated breathing of the vapor [1,2,13].

SAMPLING:

1. Calibrate each personal sampling pump with a representative sampler in line.
2. Break the ends of the Florisil tube immediately before sampling. Connect Florisil tube to Swinnex cassette and attach sampler to personal sampling pump with flexible tubing.
3. Sample at an accurately known flow rate between 0.05 and 0.2 L/min for a total sample size of 1 to 50 L.

NOTE: At low PCB concentrations, the sampler was found to be efficient when operated at flow rates up to 1 L/min, for 24 hours [8]. Under these conditions, the limit of detection was 0.02 μg/m³.

4. Transfer the glass fiber filters to 7-mL vials. Cap the Florisil tubes with plastic (not rubber) caps and pack securely for shipment.

SAMPLE PREPARATION:

5. Place the glass wool and 100-mL Florisil bed in the same 7-mL vial in which the filter was stored. Add 5.0 mL hexane.

NOTE: For surface wipe samples, extract each gauze pad with 25 mL hexane [7].

6. In a 4 mL vial, place the 50-mg Florisil bed including the two urethane plugs. Add 2.0 mL hexane.
7. Allow to stand 20 min with occasional agitation.

CALIBRATION AND QUALITY CONTROL:

8. Calibrate daily with at least five working standards over the range 10 to 500 ng PCB/mL.
 - a. Add known amounts of stock standard solution to hexane in 10-mL volumetric flasks and dilute to the mark.
 - b. Analyze together with samples and blanks (steps 11 and 12).
 - c. Prepare calibration graph (sum of areas of selected peaks vs. ng PCB/mL).
9. Determine desorption efficiency (DE) at least once for each lot of glass fiber filters and Florisil used for sampling in the calibration range (step 8). Prepare three tubes at each of five levels plus three media blanks.
 - a. Remove and discard back sorbent section of a media blank Florisil tube.
 - b. Inject known amounts of stock standard solution directly onto front sorbent section and onto a media blank filter with a microliter syringe.
 - c. Cap the tube. Allow to stand overnight.
 - d. Desorb (steps 5 through 7) and analyze together with working standards (steps 11 and 12).
 - e. Prepare a graph of DE vs. μg PCB recovered.
10. Analyze three quality control blind spikes and three analyst spikes to ensure that the calibration graph and DE graph are in control.

MEASUREMENT:

11. Set gas chromatograph according to manufacturer's recommendations and to conditions given on page 5503-1. Inject sample aliquot manually using solvent flush technique or with autosampler.

NOTE 1: Where individual identification of PCB is needed, a procedure using a capillary column may be used [14].

NOTE 2: If peak area is above the linear range of the working standards, dilute with hexane, reanalyze and apply the appropriate dilution factor in calculations.

12. Sum the areas for five or more selected peaks.

CALCULATIONS:

13. Determine the mass, ng (corrected for DE) of PCB found on the glass fiber filter (W) and in the Florisil front (W_f) and back (W_b) sorbent sections, and in the average media blank filter (B) and front (B_f) and back (B_b) sorbent sections.

NOTE: If $W_b > W_f/10$, report breakthrough and possible sample loss.

14. Calculate concentration, C, of PCB in the air volume sampled, V (L):

$$C = \frac{(W + W_f + W_b - B - B_f - B_b) \cdot 10^{-9}}{V}, \text{ mg/m}^3.$$

EVALUATION OF METHOD:

This method uses 13-mm glass fiber filters which have not been evaluated for collecting PCB. In Method S120, however, Aroclor 1242 was completely recovered from 37-mm glass fiber filters using 15 mL isooctane [12,15,16]. With 5 mL of hexane, Aroclor 1016 was also completely recovered from 100-mg Florisil beds after one-day storage [5]. Thus, with no adsorption effect likely on glass fiber filters for PCB, 5 mL hexane should be adequate to completely extract PCB from combined filters and front sorbent sections. Sample stability on glass fiber filters has not been investigated. Breakthrough volume was >48 L for the Florisil tube at 75% RH in an atmosphere containing 10 mg/m³ Aroclor 1016 [5].

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METHOD REVISED BY: James E. Arnold, NIOSH/DPSE; S120 originally validated under NIOSH Contract 210-76-0123.

Table 1. Composition of some Aroclors [3].

Major Components	Aroclor 1016	Aroclor 1242	Aroclor 1254
Biphenyl	0.1%	<0.1%	<0.1%
Monochlorobiphenyls	1	1	<0.1
Dichlorobiphenyls	20	16	0.5
Trichlorobiphenyls	57	49	1
Tetrachlorobiphenyls	21	25	21
Pentachlorobiphenyls	1	8	48
Hexachlorobiphenyls	<0.1	1	23
Heptachlorobiphenyls	none detected	<0.1	6
Octachlorobiphenyls	none detected	none detected	none detected

APPENDIX C
DECONTAMINATION PROCEDURE DETAIL

Decontamination Procedures for Three Levels of Protection^a

F.S.O.P. No. 7

Process: DECONTAMINATION PROCEDURES

INTRODUCTION

- 1.1 The objective of these procedures is to minimize the risk of exposure to hazardous substances. These procedures were derived from the U.S. Environmental Protection Agency, Office of Emergency and Remedial Response's (OERR), "Interim Standard Operating Safety Guides (revised Sep. 82)". This version of the guides is in a format that is more appropriate for use in the field.
- 1.2 Protective equipment must be worn by personnel when response activities involve known or suspected hazardous substances. The procedures for decontaminating personnel upon leaving the contaminated area are addressed for each of the EPA, OERR designated levels of protection. The procedures given are for the maximum and minimum amount of decontamination used for each level of protection.
- 1.3 The maximum decontamination procedures for all levels of protection consist of specific activities at nineteen stations. Each station emphasizes an important aspect of decontamination. When establishing a decontamination line, each aspect should be incorporated separately or combined with other aspects into a procedure with fewer steps (such as the Minimum Decontamination Procedures).
- 1.4 Decontamination lines are site specific since they are dependent upon the types of contamination and the type of work activities on site. A cooling station is sometimes necessary within the decontamination line during hot weather. It is usually a location in a shaded area in which the wind can help to cool personnel. In addition, site conditions may permit the use of cooling devices such as cool water hose, ice packs, cool towels, etc. When the decontamination line is no longer required, contaminated wash and rinse solutions and contaminated articles must be contained and disposed of as hazardous wastes in compliance with state and federal regulations.

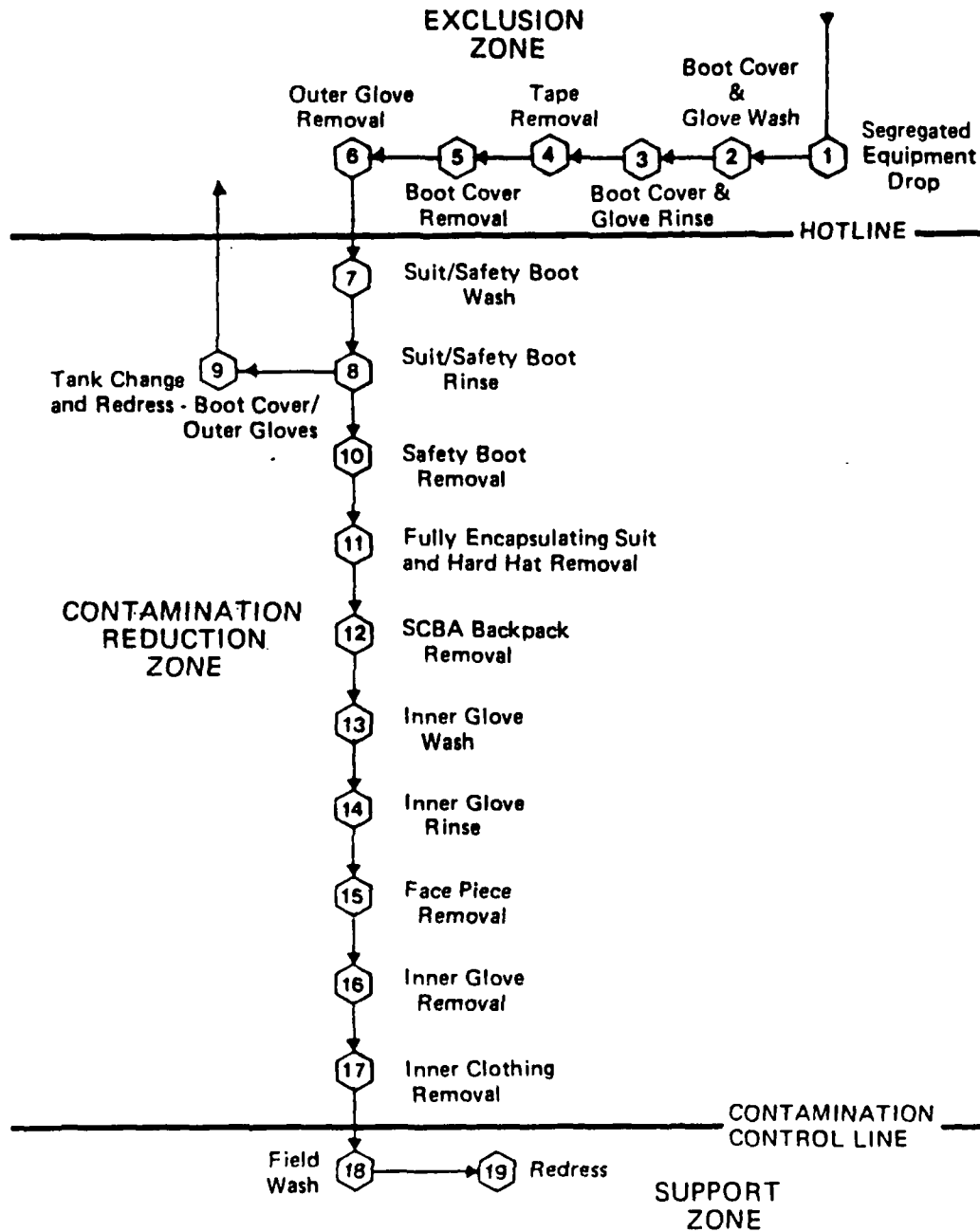
^a Source: Excerpted from *Field Standard Operating Procedures for the Decontamination of Response Personnel (FSOP 7)*. EPA Office of Emergency and Remedial Response, Hazardous Response Support Division, Washington, DC. January 1985.

F.S.O.P. No. 7

PROCESS DECON PROCEDURES

MAXIMUM DECONTAMINATION LAYOUT

LEVEL A PROTECTION

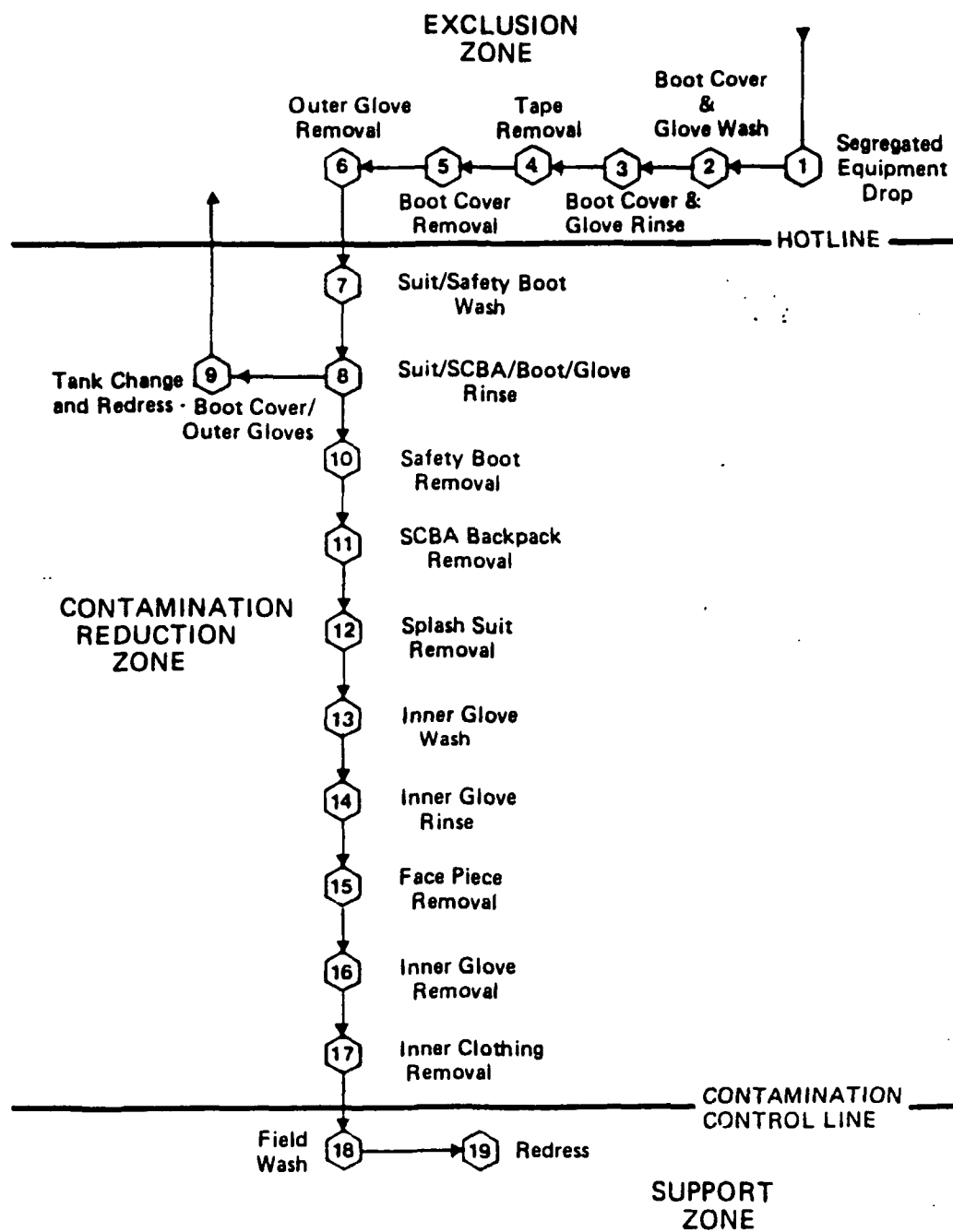


P.S.O.P. No. 7

PROCESS DECON PROCEDURES

MAXIMUM DECONTAMINATION LAYOUT

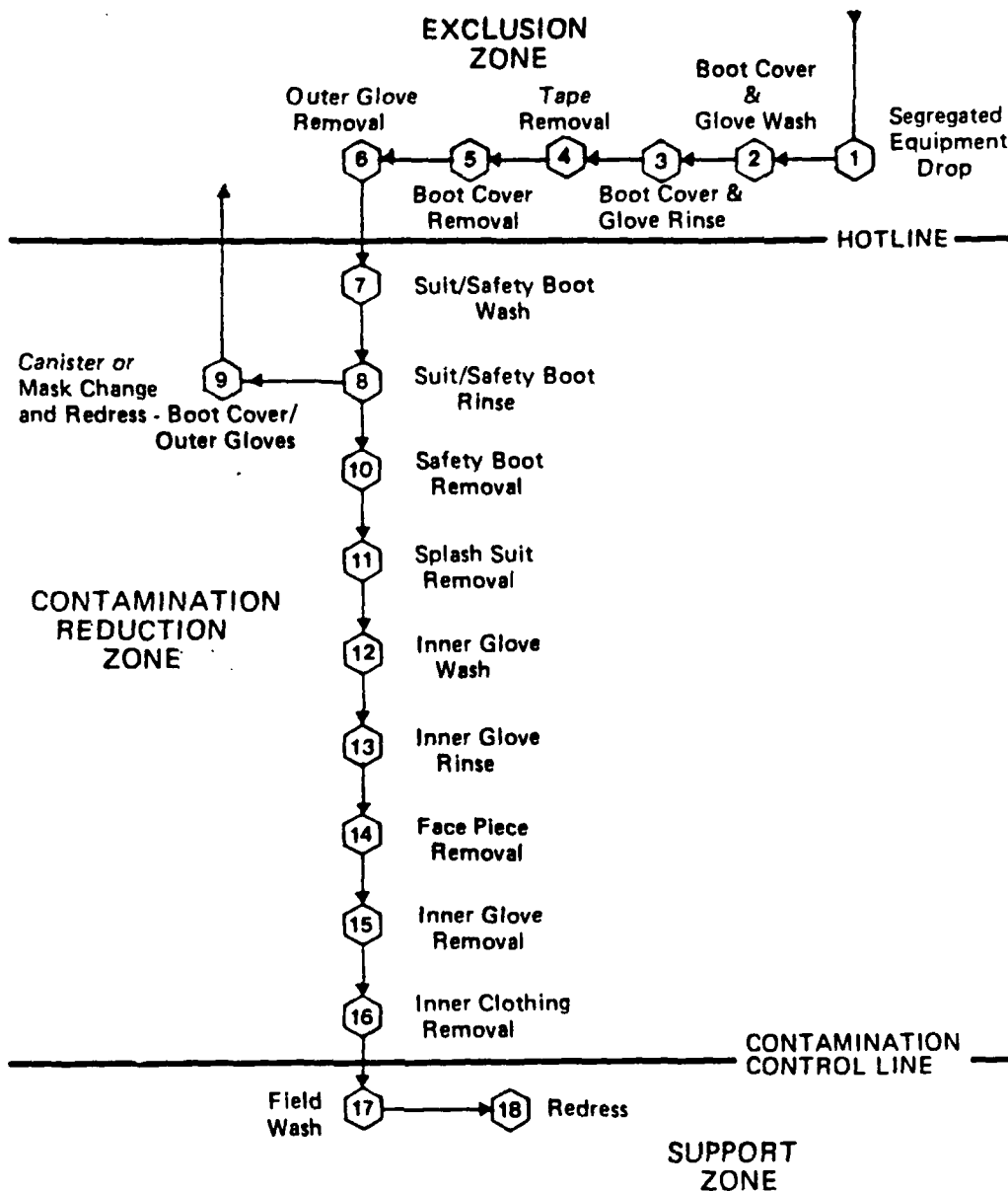
LEVEL B PROTECTION



PROCESS DECON PROCEDURES

MAXIMUM DECONTAMINATION LAYOUT

LEVEL C PROTECTION

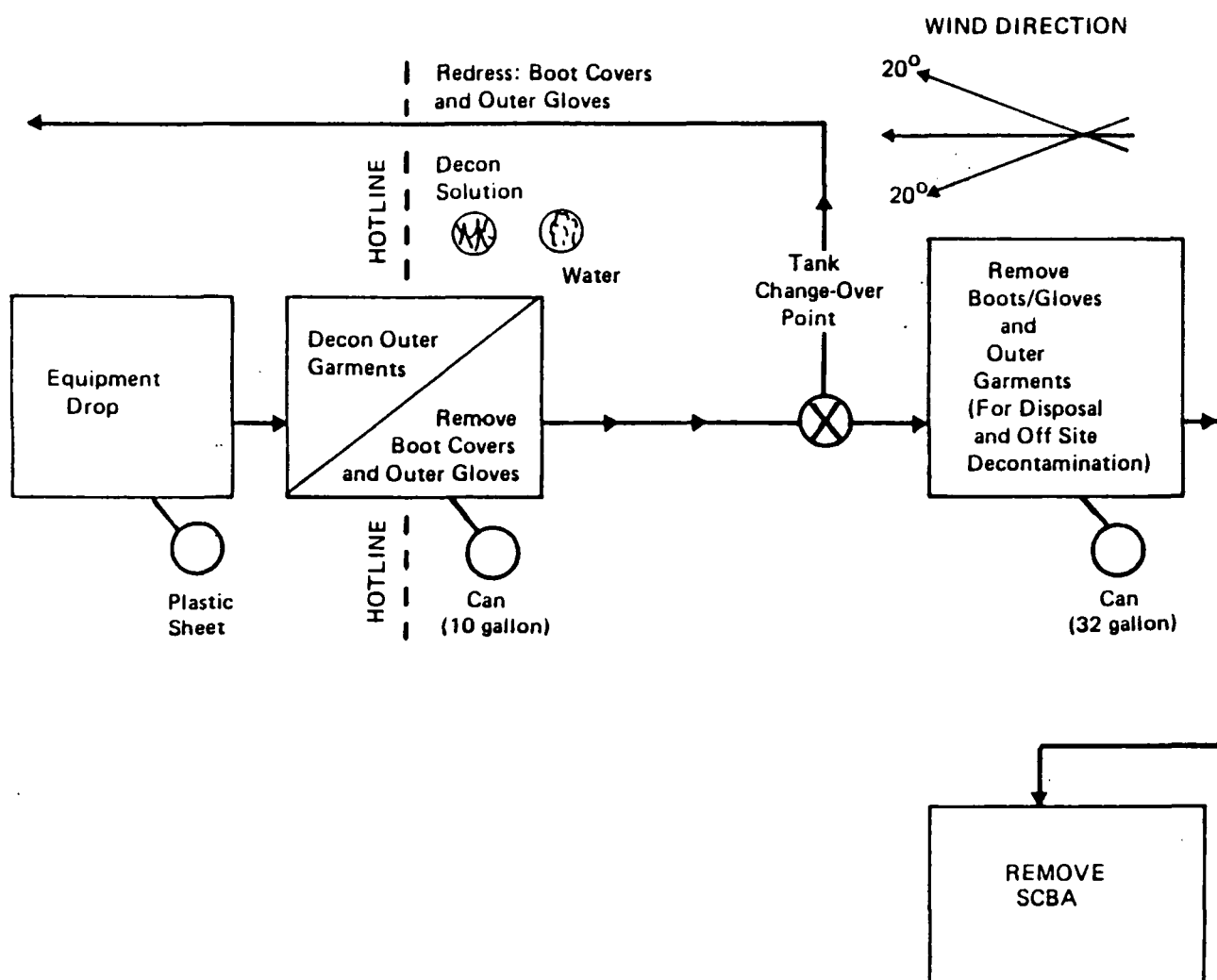


P.S.O.P. No. 7

PROCESS DECON PROCEDURES

MINIMUM DECONTAMINATION LAYOUT

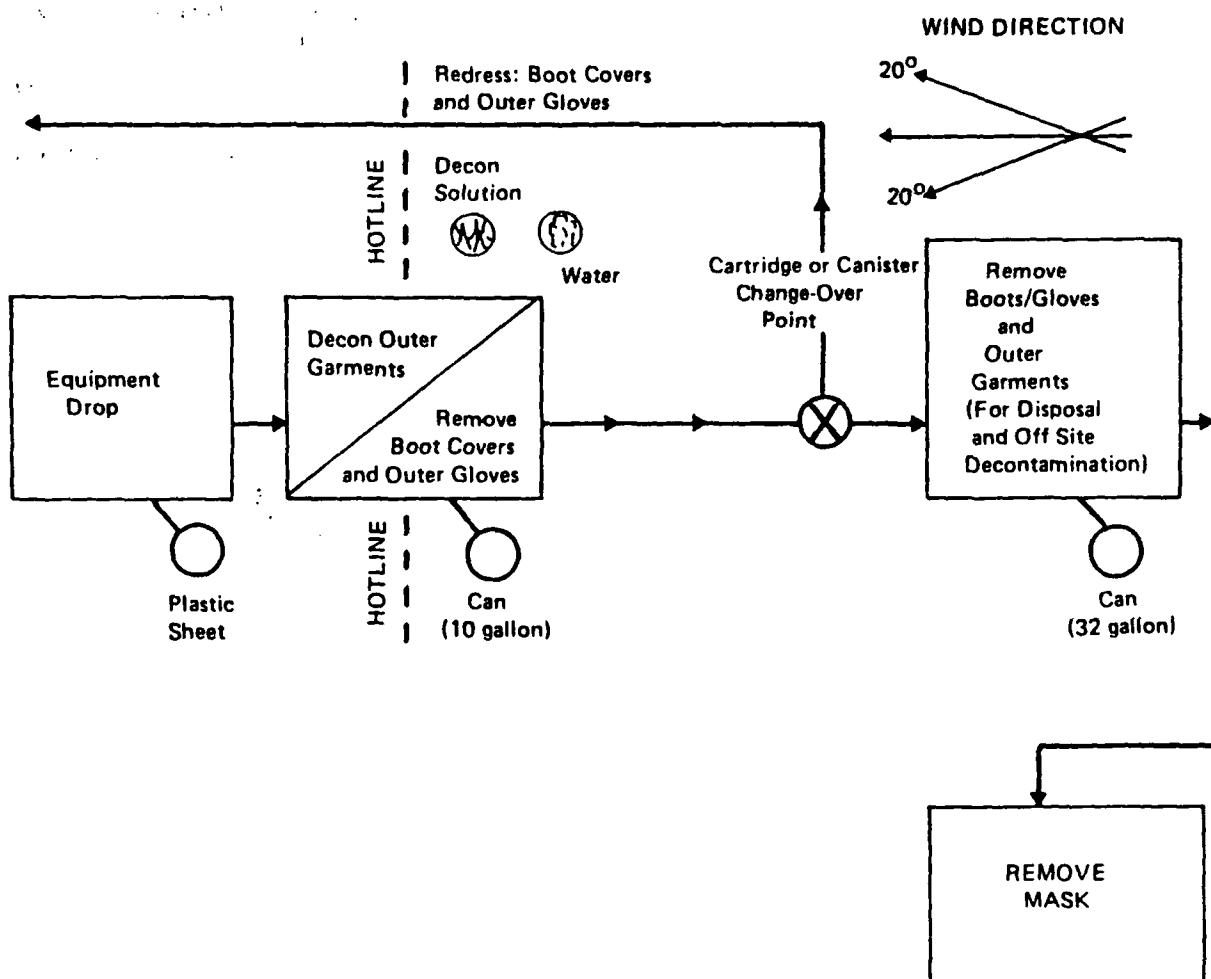
LEVELS A & B PROTECTION



PROCESS DECON PROCEDURES

MINIMUM DECONTAMINATION LAYOUT

LEVEL C PROTECTION



EQUIPMENT NEEDED TO PERFORM MAXIMUM DECONTAMINATION MEASURES FOR LEVELS A, B, AND C

- | | |
|--|---|
| Station 1: a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths | Station 10: a. Containers (20-30 Gallons)
b. Plastic Liners
c. Bench or Stools
d. Boot Jack |
| Station 2: a. Containers (20-30 Gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes | Station 11: a. Rack
b. Drop Cloths
c. Bench or Stools |
| Station 3: a. Containers (20-30 Gallons)
OR
High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes | Station 12: a. Table |
| Station 4: a. Containers (20-30 Gallons)
b. Plastic Liners | Station 13: a. Basin or Bucket
b. Decon Solution
c. Small Table |
| Station 5: a. Containers (20-30 Gallons)
b. Plastic Liners
c. Bench or Stools | Station 14: a. Water
b. Basin or Bucket
c. Small Table |
| Station 6: a. Containers (20-30 Gallons)
b. Plastic Liners | Station 15: a. Containers (20-30 Gallons)
b. Plastic Liners |
| Station 7: a. Containers (20-30 Gallons)
b. Decon Solution or Detergent Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes | Station 16: a. Containers (20-30 Gallons)
b. Plastic Liners |
| Station 8: a. Containers (20-30 Gallons)
OR
High-Pressure Spray Unit
b. Water
c. 2-3 Long-Handled, Soft-Bristled Scrub Brushes | Station 17: a. Containers (20-30 Gallons)
b. Plastic Liners |
| Station 9: a. Air Tanks or Face Masks and Cartridge Depending on Level
b. Tape
c. Boot Covers
d. Gloves | Station 18: a. Water
b. Soap
c. Small Table
d. Basin or Bucket
e. Field Showers
f. Towels |
| | Station 19: a. Dressing Trailer is Needed in Inclement Weather
b. Tables
c. Chairs
d. Lockers
e. Cloths |
-

EQUIPMENT NEEDED TO PERFORM MINIMUM DECONTAMINATION MEASURES FOR LEVELS A, B, AND C

- | | |
|---|--|
| Station 1: a. Various Size Containers
b. Plastic Liners
c. Plastic Drop Cloths | Station 4: a. Air Tanks or Masks and Cartridges Depending Upon Level
b. Tape
c. Boot Covers
d. Gloves |
| Station 2: a. Containers (20-30 Gallons)
b. Decon Solution
c. Rinse Water
d. 2-3 Long-Handled, Soft-Bristled Scrub Brushes | Station 5: a. Containers (20-30 Gallons)
b. Plastic Liners
c. Bench or Stools |
| Station 3: a. Containers (20-30 Gallons)
b. Plastic Liners
c. Bench or Stools | Station 6: a. Plastic Sheets
b. Basin or Bucket
c. Soap and Towels
d. Bench or Stools |
| | Station 7: a. Water
b. Soap
c. Tables
d. Wash. Basin or Bucket |

FSOP 7: MAXIMUM MEASURES FOR LEVEL A DECONTAMINATION

- | | |
|---|--|
| Station 1: Segregated Equipment Drop | 1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. During hot weather operations, a cool down station may be set up within this area. |
| Station 2: Boot Cover and Glove Wash | 2. Scrub outer boot covers and gloves with decon solution or detergent/water. |
| Station 3: Boot Cover and Glove Rinse | 3. Rinse off decon solution from station 2 using copious amounts of water. |
| Station 4: Tape Removal | 4. Remove tape around boots and gloves and deposit in container with plastic liner. |
| Station 5: Boot Cover Removal | 5. Remove boot covers and deposit in container with plastic liner. |
| Station 6: Outer Glove Removal | 6. Remove outer gloves and deposit in container with plastic liner. |
| Station 7: Suit and Boot Wash | 7. Wash encapsulating suit and boots using scrub brush and decon solution or detergent/water. Repeat as many times as necessary. |
| Station 8: Suit and Boot | 8. Rinse off decon solution using water. Repeat as many times as necessary. |
| Station 9: Tank Change | 9. If an air tank change is desired, this is the last step in the decontamination procedure. Air tank is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty. |
| Station 10: Safety Boot Removal | 10. Remove safety boots and deposit in container with plastic liner. |
| Station 11: Fully Encapsulating Suit and Hard Hat Removal | 11. Fully encapsulated suit is removed with assistance of a helper and laid out on a drop cloth or hung up. Hard hat is removed. Hot weather rest station maybe set up within this area for personnel returning to site. |
| Station 12: SCBA Backpack Removal | 12. While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve and proceed to next station. |
| Station 13: Inner Glove Wash | 13. Wash with decon solution that will not harm the skin. Repeat as often as necessary. |
| Station 14: Inner Glove Rinse | 14. Rinse with water. Repeat as many times as necessary. |
| Station 15: Face Piece Removal | 15. Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. |
| Station 16: Inner Glove Removal | 16. Remove inner gloves and deposit in container with liner. |

FSOP 7: MAXIMUM MEASURES FOR LEVEL A DECONTAMINATION

- | | |
|------------------------------------|---|
| Station 17: Inner Clothing Removal | 17. Remove clothing and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit. |
| Station 18: Field Wash | 18. Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available. |
| Station 19: Redress | 19. Put on clean clothes. |

FSOP 7: MINIMUM MEASURES FOR LEVEL A DECONTAMINATION

- | | |
|--|---|
| Station 1: Equipment Drop | 1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations maybe set up within this area. |
| Station 2: Outer Garment, Boots, and Gloves Wash and Rinse | 2. Scrub outer boots, outer gloves and fully-encapsulating suit with decon solution or detergent and water. Rinse off using copious amounts of water. |
| Station 3: Outer Boot and Glove Removal | 3. Remove outer boots and gloves. Deposit in container with plastic liner. |
| Station 4: Tank Change | 4. If worker leaves Exclusion Zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty. |
| Station 5: Boot, Gloves and Outer Garment Removal | 5. Boots, fully-encapsulating suit, inner gloves removed and deposited in separate containers lined with plastic. |
| Station 6: SCBA Removal | 6. SCBA backpack and facepiece is removed (avoid touching face with fingers). SCBA deposited on plastic sheets. |
| Station 7: Field Wash | 7. Hands and face are thoroughly washed. Shower as soon as possible. |

FSOP 7: MAXIMUM MEASURES FOR LEVEL B DECONTAMINATION

- | | |
|--|--|
| Station 1: Segregated Equipment Drop | 1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, cooldown stations may be set up within this area. |
| Station 2: Boot Cover and Glove Wash | 2. Scrub outer boot covers and gloves with decon solution or detergent and water. |
| Station 3: Boot Cover and Glove Rinse | 3. Rinse off decon solution from station 2 using copious amounts of water. |
| Station 4: Tape Removal | 4. Remove tape around boots and gloves and deposit in container with plastic liner. |
| Station 5: Boot Cover Removal | 5. Remove boot covers and deposit in container with plastic liner. |
| Station 6: Outer Glove removal | 6. Remove outer gloves and deposit in container with plastic liner. |
| Station 7: Suit and Safety Boot Wash | 7. Wash chemical-resistant splash suit, SCBA, gloves and safety boots. Scrub with long-handle scrub brush and decon solution. Wrap SCBA regulator (if belt mounted type) with plastic to keep out water. Wash backpack assembly with sponges or cloths. |
| Station 8: Suit, SCBA, Boot, and Glove Rinse | 8. Rinse off decon solution using copious amounts of water. |
| Station 9: Tank Change | 9. If worker leaves exclusion zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty. |
| Station 10: Safety Boot Removal | 10. Remove safety boots and deposit in container with plastic liner. |
| Station 11: SCBA Backpack Removal | 11. While still wearing facepiece, remove backpack and place on table. Disconnect hose from regulator valve. |
| Station 12: Splash Suit Removal | 12. With assistance of helper, remove splash suit. Deposit in container with plastic liner. |
| Station 13: Inner Glove Wash | 13. Wash inner gloves with decon solution. |
| Station 14: Inner Glove Rinse | 14. Rinse inner gloves with water. |
| Station 15: Face Piece Removal | 15. Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. |
| Station 16: Inner Glove Removal | 16. Remove inner gloves and deposit in container with liner. |

FSOP 7: MAXIMUM MEASURES FOR LEVEL B DECONTAMINATION

- | | |
|------------------------------------|---|
| Station 17: Inner Clothing Removal | 17. Remove inner clothing. Place in container with liner. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit. |
| Station 18: Field Wash | 18. Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available. |
| Station 19: Redress | 19. Put on clean clothes. |

FSOP 7: MINIMUM MEASURES FOR LEVEL B DECONTAMINATION

- | | |
|--|---|
| Station 1: Equipment Drop | 1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down station may be set up within this area. |
| Station 2: Outer Garment, Boots, and Gloves Wash and Rinse | 2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent water. Rinse off using copious amounts of water. |
| Station 3: Outer Boot and Glove Removal | 3. Remove outer boots and gloves. Deposit in container with plastic liner. |
| Station 4: Tank Change | 4. If worker leaves exclusive zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty. |
| Station 5: Boot, Gloves and Outer Garment Removal | 5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic. |
| Station 6: SCBA Removal | 6. SCBA backpack and facepiece is removed. Avoid touching face with finger. SCBA deposited on plastic sheets. |
| Station 7: Field Wash | 7. Hands and face are thoroughly washed. Shower as soon as possible. |

FSOP 7: MAXIMUM MEASURES FOR LEVEL C DECONTAMINATION

- | | |
|---|--|
| Station 1: Segregated Equipment Drop | 1. Deposit equipment used on site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area. |
| Station 2: Boot Cover and Glove Wash | 2. Scrub outer boot covers and gloves with decon solution or detergent and water. |
| Station 3: Boot Cover and Glove Rinse | 3. Rinse off decon solution from station 2 using copious amounts of water. |
| Station 4: Tape Removal | 4. Remove tape around boots and gloves and deposit in container with plastic liner. |
| Station 5: Boot Cover Removal | 5. Remove boot covers and deposit in containers with plastic liner. |
| Station 6: Outer Glove Removal | 6. Remove outer gloves and deposit in container with plastic liner. |
| Station 7: Suit and Boot Wash | 7. Wash splash suit, gloves, and safety boots. Scrub with long-handle scrub brush and decon solution. |
| Station 8: Suit and Boot, and Glove Rinse | 8. Rinse off decon solution using water. Repeat as many times as necessary. |
| Station 9: Canister or Mask Change | 9. If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped worker returns to duty. |
| Station 10: Safety Boot Removal | 10. Remove safety boots and deposit in container with plastic liner. |
| Station 11: Splash Suit Removal | 11. With assistance of helper, remove splash suit. Deposit in container with plastic liner. |
| Station 12: Inner Glove Rinse | 12. Wash inner gloves with decon solution. |
| Station 13: Inner Glove Wash | 13. Rinse inner gloves with water. |
| Station 14: Face Piece Removal | 14. Remove face piece. Deposit in container with plastic liner. Avoid touching face with fingers. |
| Station 15: Inner Glove Removal | 15. Remove inner gloves and deposit in lined container. |

FSOP 7: MAXIMUM MEASURES FOR LEVEL C DECONTAMINATION

- | | |
|------------------------------------|--|
| Station 16: Inner Clothing Removal | 16. Remove clothing soaked with perspiration and place in lined container. Do not wear inner clothing off-site since there is a possibility that small amounts of contaminants might have been transferred in removing the fully-encapsulating suit. |
| Station 17: Field Wash | 17. Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available. |
| Station 18: Redress | 18. Put on clean clothes. |

FSOP 7: MINIMUM MEASURES FOR LEVEL C DECONTAMINATION

- | | |
|--|---|
| Station 1: Equipment Drop | 1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area. |
| Station 2: Outer Garment, Boots, and Gloves Wash and Rinse | 2. Scrub outer boots, outer gloves and splash suit with decon solution or detergent water. Rinse off using copious amounts of water. |
| Station 3: Outer Boot and Glove Removal | 3. Remove outer boots and gloves. Deposit in container with plastic liner. |
| Station 4: Canister or Mask Change | 4. If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty. |
| Station 5: Boot, Gloves and Outer Garment Removal | 5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic. |
| Station 6: Face Piece Removal | 6. Facepiece is removed. Avoid touching face with fingers, Facepiece deposited on plastic sheet. |
| Station 7: Field Wash | 7. Hands and face are thoroughly washed. Shower as soon as possible. |